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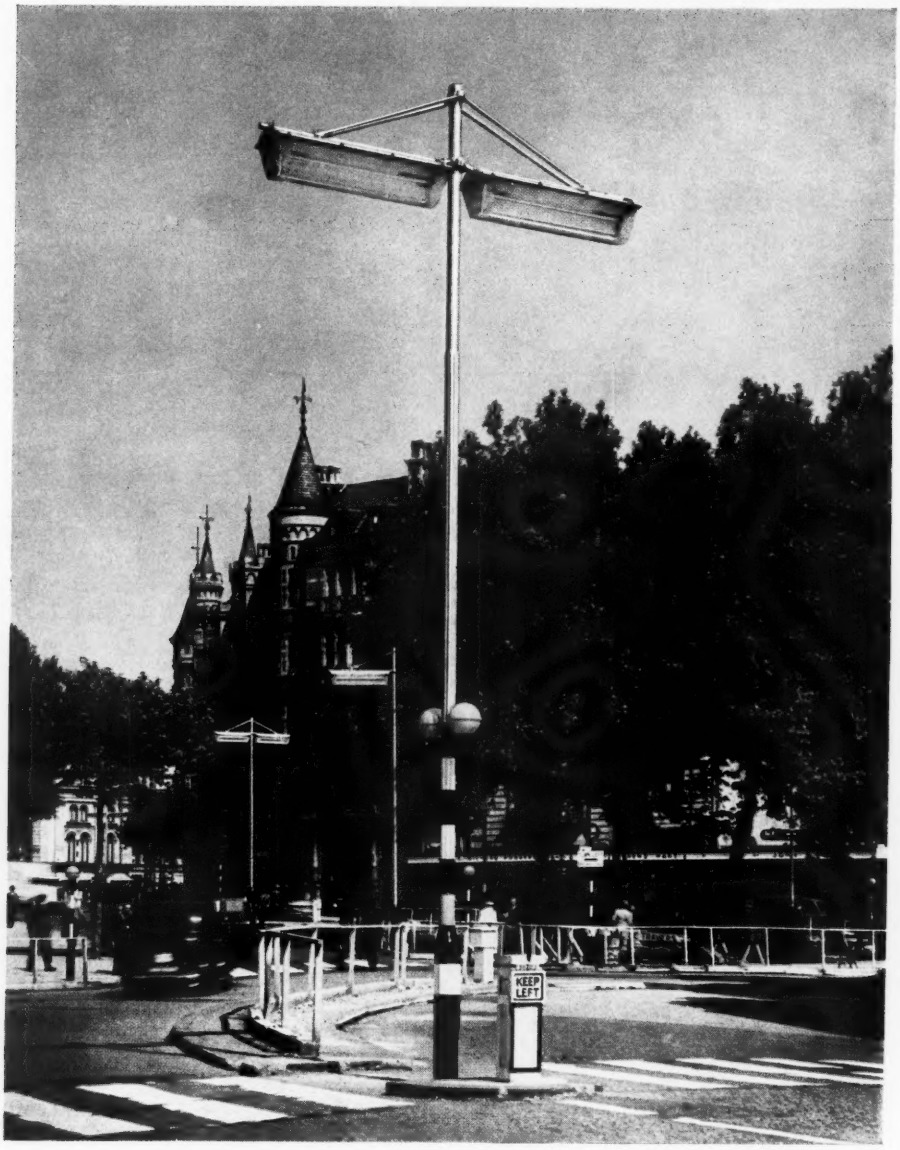

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2 MARCH 1956

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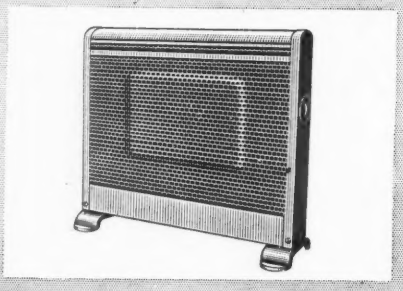

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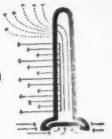

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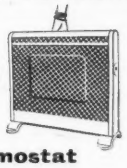

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ELECTRICAL REVIEW

2 March 1956 Vol. 158 No. 9 Established 1872

Brake on Development

THE two-day debate in the House of Commons last week on the economic situation showed clearly that there is anxiety over the long-term implications of the severe cuts in capital investment announced by the Chancellor of the Exchequer. Our economic policy as Mr. Macmillan himself said must, over the years, be positive, expansive and constructive. " But," he added, " there is a season of growth and a season of pruning. Let us hope that, after the pruning, when we are sure it has done its work, the growth will start again with renewed vigour."

Past experience has shown that such pruning can have disastrous consequences. The emphasis of the future must surely be on higher productivity and this requires more mechanisation, more automation and consequently more investment in equipment. A great deal has already been achieved. Sir Edward Boyle, the Economic Secretary to the Treasury, indicated that there had, in fact, been an 18 per cent increase in investment by manufacturing industry in 1955. This has undoubtedly contributed to the success of the engineering industry in overseas markets. Thus the returns for January just published show that although the balance of trade position deteriorated, owing mainly to reduced exports of coal and textiles, exports of electrical machinery and goods advanced to £18.9 million as compared with £17 million in January, 1955. The curbing of investment may make it impossible for this steady and satisfactory expansion to continue.

As far as the electricity supply industry is concerned, the risks are equally great. When last year's cuts in expenditure were announced it was stated that they would be mainly on the distribution and utilisation side but—more serious still—it now appears that generation is also involved. In replying to a question last week the Minister of Fuel and Power said that the reduction of £19 million in electricity expenditure was to be shared evenly between generation and distribution. We can only repeat our hope, previously expressed, that it will soon be possible to restore the industry's full programme of capital development.

Direct control of investments, so that less essential items can be postponed and vital projects encouraged, is favoured by the T.U.C. General Council in a statement commenting on the Chancellor's proposals in which it emphasises the importance of increasing productivity and efficiency. The T.U.C. also feels that a selective reduction of imports would provide a more effective and less harmful way of cutting the import bill than the " credit squeeze." Another suggestion made is that purchase tax on household necessities should be abolished or reduced. Though intended to be anti-inflationary this tax, as the Federation of British Industries has pointed out, may in the long run be the reverse in view of its effect upon costs.

POWER STATION FUEL SUPPLIES

As a result of policy laid down by the Government, the Central Electricity Authority is using oil for fuel in a number of its power stations. We have visited a few generating stations in this category during the last month or so and it has occurred to us that although a considerable amount of coal could be saved during a year in this way the scheme has not been extended nearly enough, since only about 0·05 per cent of the electricity generated in this country is produced in oil fired stations.

Apart from all this the Central Electricity Authority is, quite rightly, installing in the new stations complete coal handling and firing equipment as well as that required for oil firing. Although this is a very good insurance against shortage of fuel oil it does mean that throughout the country many millions of pounds worth of equipment is lying idle. Undoubtedly the scheme is one of coal conservation and not an economic policy of the C.E.A. or the oil companies.

NUCLEAR ENERGY

Just before going to Press with this issue we read in one of the daily newspapers a reference to " H-bomb power " and it appeared that the Atomic Energy Authority was about to make an announcement relating to the prospects of utilising " hydrogen bomb techniques " for peace-time purposes. While we strongly dislike the term " H-bomb power " because it recalls the loose, cumbersome and misleading expressions of the earlier days of nuclear development, we feel that we cannot shut our eyes to the possible background, particularly in view of Sir Christopher Hinton's declaration at the Geneva Conference last year, namely, that no one knows what lies round the corner in connection with nuclear energy development.

The electrical industry has the greatest interest in nuclear development of any industry or organisation commercially, and it is right and proper therefore that we should guardedly keep our eyes open in connection with all these predictions, however cumbersome and misleading they may appear to be at first sight.

LOAD FACTOR

We have already commented on the recommendation in the Herbert Committee's Report that improvement of load factor by electricity supply authorities should be tackled more vigorously. Load factor development, however, has, right from the beginning of electricity supply development, been the supply engineer's goal, dream or bugbear; and while we have often thought that he has sometimes been lacking in enthusiasm as the result of everyday acquaintance with the problem we cannot believe that he has grown to be unaware of its existence.

The Report says: " The greatest single contribution that could be made to improve the British load factor would be the introduction of extended shift working in industry." Such a move would involve politics and we therefore challenge the statement in so far as saying that it is not the greatest single practical contribution that could be made. On the electrical platform over many years supply engineers and managers have said that the greatest single contribution of the supply engineer himself would be the creation of a demand for electricity on an off-peak basis—in short, electric space heating. Behind the scenes we have often heard it said that the supply man feared an all-out demand for electric space heating because of the up-rooting and drastic reinforcement or renewal of the distribution system which would be called for. We have yet to hear this said openly on the platform, however.

INADEQUATE LIBRARY FACILITIES

A distressing state of affairs is revealed in a memorandum adopted by the Library Association recently and forwarded for consideration by the Scientific and Technical Information Committee of the Advisory Council on Scientific Policy of the Lord President of the Council. It points out that in the British Isles there are 555 Institutions dealing with technical education and of these only 160 possess 300 or more books housed in a room called a library. The time these libraries are open to students varies from five to more than 60 hours per week but this is not surprising since only 24 have a staff, including the librarian, of two or more full-time individuals.

It is evident that not nearly enough money is being spent on college libraries and a statement of Government policy in this connection for the various grades of technical college is urgently required. There is no doubt that the provision of adequate library services in the technical colleges would make a considerable contribution to the successful dissemination of technical information and would also assist the Government's policy in the training of qualified technologists in this country.

RING MAIN FUSING

A recent discussion with a well-known domestic electrical accessory manufacturer provided us with facts to back a belief we have long held privately: namely that much of the theoretical good of the 13 A ring main system with its associated fused plugs is not being realised in practice. This firm supplies fused plugs to the orders of wholesalers or retailers and finds that about 90 per cent of its output is requested fitted with 13 A fuses. The remaining 10 per cent is divided between 3 A and 7 A fuses.

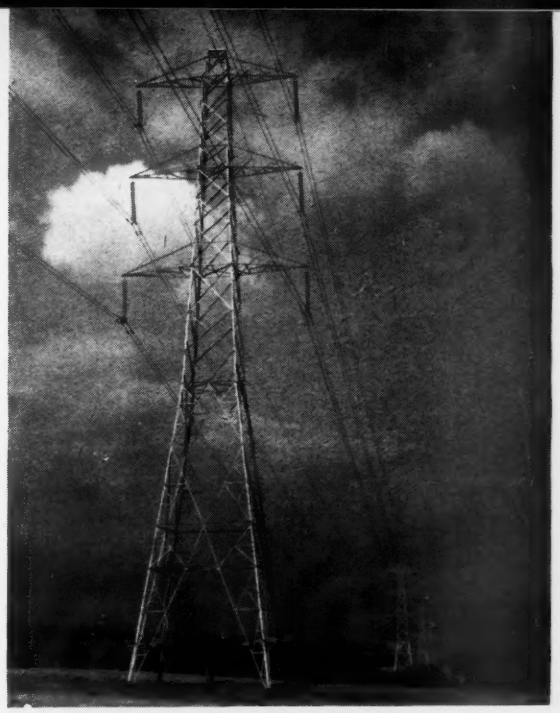
Consideration of the varied appliances used in an average home, office, or similar establishment would show, we feel sure, an overwhelming preponderance of portable appliances well within the correct scope of the 7 A fuse, let alone the 3 A size. All standard, table or desk lamps come within the 3 A range and it seems scarcely credible that these make up less than 5 per cent of the total of plug using items. One is led to the conclusion—amply borne out when trying to buy a plug with other than a 13 A fuse—that innumerable cases must exist of retailers selling appliances with plugs of incorrect fusing. Much continued emphasis is required—and our readers can play their part—on the need for correct fusing whenever a 13 A ring main system is involved.

The Scottish Inheritance

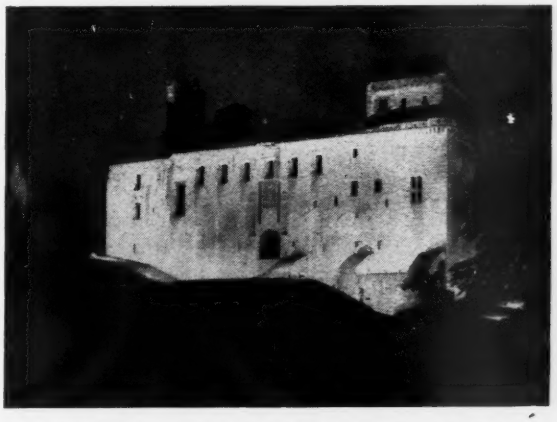
CONSUMERS AND TARIFFS IN THE SOUTH OF SCOTLAND BOARD'S AREA

LAST week we described the pattern of generation, transmission and distribution in this area. This week we consider the consumers. Easily the largest single customer in the area is the National Coal Board, although its supply is inevitably taken at very many individual points and when examined in this way no single point of supply can claim pride of place in consumption figures. A dramatic new colliery is that at Rothes in Fife where a new town known as Glenrothes has been started. Our illustration shows the striking appearance of the colliery buildings, a great contrast to the old winding heads and chimneys of not so long ago. Each of the 193ft high towers houses two shafts, those in one being designed for coal only and those in the other for men and materials. The ultimate electrical demand of this colliery is expected to be about 15 MW and its output of coal when it gets into full production should be between 5,000 and 8,000 tons per day. The biggest power users are the twin 1,890 h.p. motors driving each winder and situated on the top floor of the towers: in the room immediately below are the motor generator sets which supply them. Other large items are the two 1,050 h.p. synchronous motors on the ventilating system and motors of the order of 1,000 h.p. used for pumping water from the shafts.

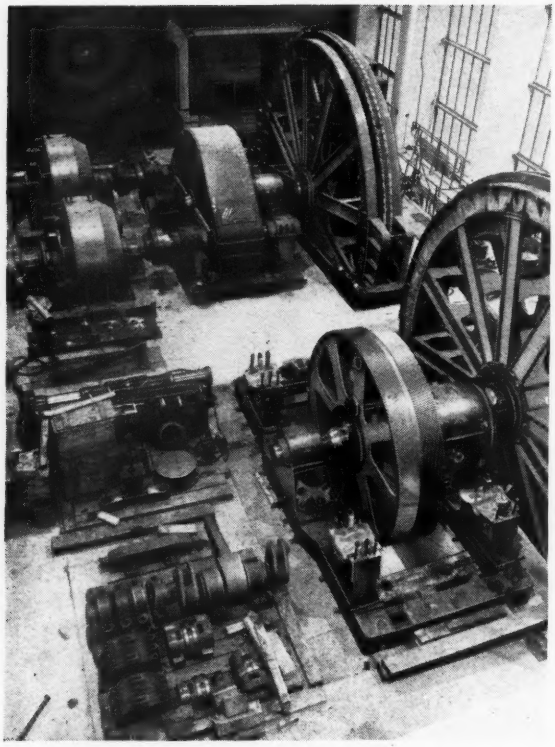
Among the largest consumers at any one point of supply are an I.C.I. fertilizer factory with a maximum demand of about 11,400 kVA and load factor of the order of 80 per



The 275 kV line from Glasgow to Carlisle sweeps boldly across the countryside



Above right: Linlithgow palace, birthplace of Mary, Queen of Scots, and a strong and stern reminder of the troubled times that fill the pages of Scotland's mediaeval history. Below: Rothes colliery, a striking example of modern construction



The winder house at the top of one of the towers at Rothes colliery. For each winder two 1,890 h.p. d.c. motors, driving on to common gearing, are used

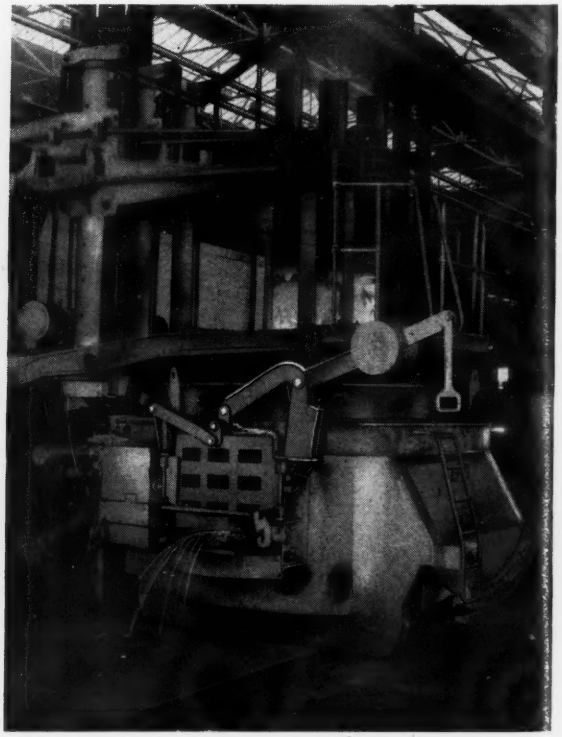
cent; and the British Aluminium Co.'s works at Bainsford with a demand of almost 10,000 kVA. Among the others worth noting are the steelworks of Colvilles, Beardmores, Clyde Alloy, and Stewarts & Lloyds; the Clyde Navigation Trust; Babcock & Wilcox; the British Oxygen Company; and Coats United Thread Mills.

Steelworks form a major power consuming industry in the area as is evident from the number of them among the top ten consumers we have named. Large electric furnaces are contemplated at several of these works and at others. An interesting example of such a furnace in use was seen at the works of the North British Steel Foundry, Ltd., at Bathgate. This is a medium-sized up-to-date specialist works making castings in carbon, low and medium alloy steel with an annual output of about 6,000 tons. Steelmaking is concentrated in a new shop containing a 2,500 kW electric arc furnace of the most modern type for basic operations, with an output of $3\frac{1}{2}$ tons; and a metallurgical blast cupola of Belgian design and the first of its kind in this country. This is designed for continuous tapping and a fine degree of operational control is exercised over the blast temperature and other variables from a nearby control panel. Two 30 cwt side blown convertors complete the equipment of the steelmaking shop. Automatic pyrometric recorders provide temperature control of the electric arc furnace. Steel produced by the furnace is found to be cheaper than that from the conventional type, although the process is slower.

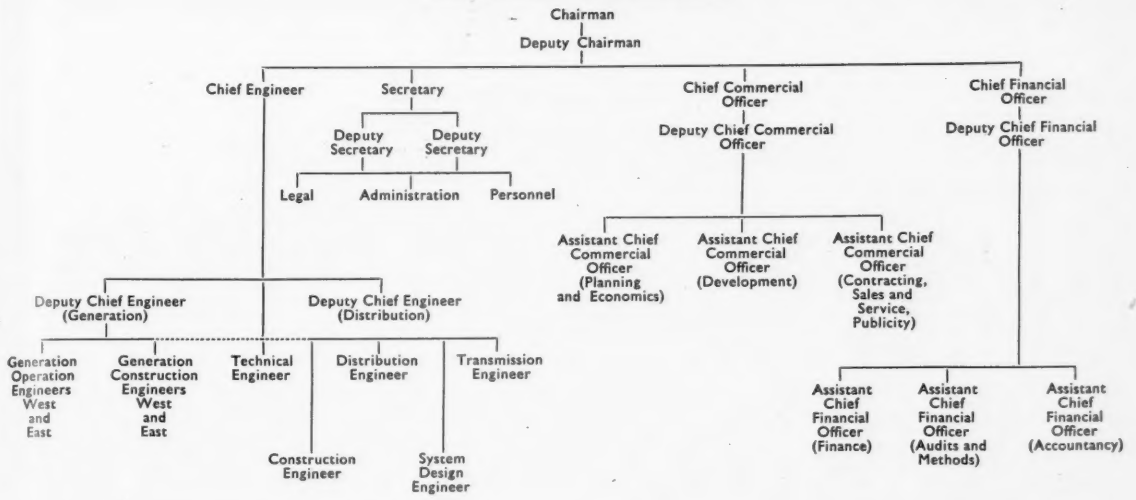
Commercial Policy

The commercial policy pursued by the Board is a very active one, particular attention being paid in the domestic field to the propagation of electric cooking. The years from 1950 to 1953 saw a steady rise in the number of electric cookers sold, either for cash or on hire-purchase. In 1954

The old and the new. Two 30 cwt converters and a $3\frac{1}{2}$ ton electric arc furnace at the Bathgate works of the North British Steel Foundry. At the time the photograph on the right was taken one of the carbon electrodes had broken and the line of the break can be clearly seen



HEADQUARTERS ORGANIZATION



a simple hire scheme was introduced and although this did not appear to affect sales under cash or h.p. terms, the number of cookers distributed sprang from 8,662 in 1952-53 to 27,425 in 1954-55, including 16,335 hired cookers. Cooker policy has been handicapped in the past by the discouraging attitude of many municipalities to the installation of electric cookers in council houses. Glasgow was the largest among these and only very recently were tenants of Corporation houses or flats given freedom to choose between gas and electric cookers. This fact alone should considerably stimulate cooker connections in the future.

Interest in commercial electric cooking has been widely developed. Several large hotels in the area have turned completely over to it and a major proportion of the cooking in the Glasgow College of Domestic Science and in the Scottish Hotel School at Ross Hall, just outside Glasgow (the only one of its kind in the country), is done electrically, auguring well for future interest in electric cooking. A children's cooking competition is organized each year by the Board and this attracted 5,000 entrants in 1955.

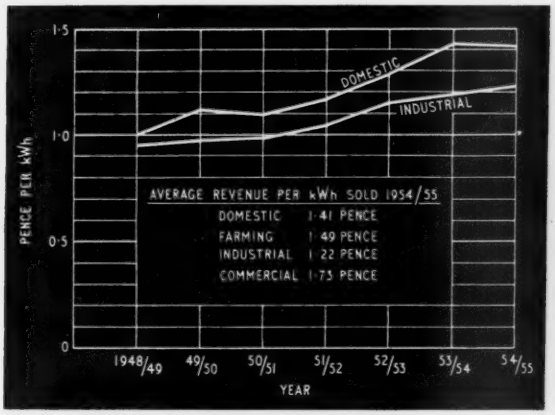
Standard tariffs are offered throughout the area. The domestic tariff consists of a charge of 4½d for each of the first 15 kWh per chargeable room a quarter, plus 1d for each additional kWh. The farm tariff charges 4½d for each of the first 15 kWh per chargeable room and for each of the next 100 kWh per quarter, thereafter 1¾d for each of the next 800 kWh per quarter, and for any additional energy 1d/kWh. A general block tariff applicable to most other consumers consists of a charge of 4½d for each of the first 100 kWh in each quarter and 1¾d for each additional kWh. A maximum demand tariff applicable to most industrial consumers is also available.

Off-peak loads are strongly encouraged. So successful indeed have been the Board's efforts in this direction that in the old South West Scotland Area over 24 MW of off-peak load has been approved in the past two years and in the old South East Area nearly 15 MW of off-peak electric space heating has been installed.

The tariff offered to encourage off-peak use is a generous one, and on a medium voltage supply varies with the periods required as follows:—Where the supply is disconnected from 7 a.m. to 11 a.m. and from 3 p.m. to 7 p.m. daily, except Saturdays and Sundays, the price per kWh is 0·55d. Where the supply is disconnected from 8 a.m. to 10 a.m. and from 3 p.m. to 5 p.m. daily, except Saturdays and Sundays, the price per kWh is 0·60d. Where the supply is disconnected from 8 a.m. to 10 a.m. and from 3 p.m. to 5 p.m. daily, except Saturdays and Sundays, during the months of November, December, January and February only, the price per kWh is 0·65d. In addition there is a variation in the unit charge of ·0007d for each penny by which the fuel cost per ton exceeds 60s in the last month in which such a cost was ascertained. At present this raises the unit charge quoted earlier by about 0·18d, the average figure paid for such off-peak supplies being about 0·75d/kWh.

Mr. J. S. Pickles the Board's Chairman

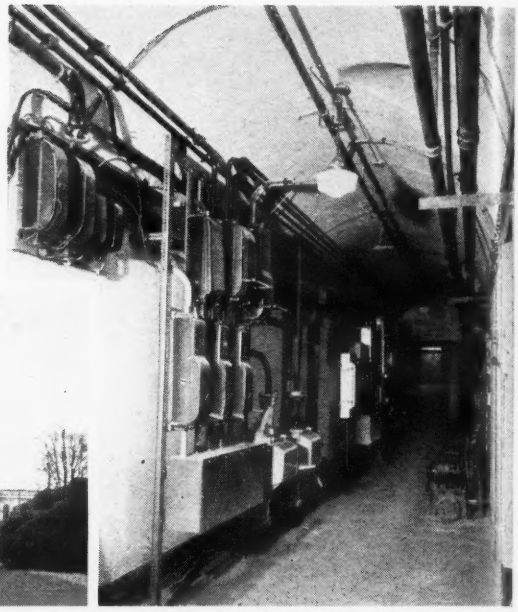
The Board is very interested in the promotion of under-floor electric heating for use during off-peak periods and a number of installations have been carried out in schools and blocks of flats. Two blocks of ten-storey flats each containing 60 dwellings are to be constructed in Edinburgh using this form of heating exclusively and two ten-storey blocks in Glasgow. A block of 48 flats at Kirkcaldy using under-floor heating was completed earlier this year and operational results to date fully bear out all expecta-



tions. In Edinburgh's College of Agriculture 1,200 kW of under-floor heating is installed. The loading used for this class of heating is between 8 and 15 W/sq ft and the system usually employed makes use of embedded housings into which the heating cables can be drawn or withdrawn at any later date for replacement.

A number of night storage block type heating installations are also in use; a typical one at an Edinburgh hotel uses 250 kW of these heaters, which can of course be plugged in to ordinary socket outlets.

Another activity planned by the Board was the recent Electronics and Productivity Exhibition and Conference held at the Kelvin Hall, Glasgow, in conjunction with the Scottish Committee of the British Productivity Council. About 30,000 sq ft of space was taken and it proved a highly successful show of particular interest to Scottish industrialists.



A country hotel in Galloway with installed plant totalling 450 kW. The service corridor seen is an admirable example of installation methods in an old building

Although the South of Scotland Board is now a completely separate entity, in the hour-by-hour operations of the country's electricity system nothing is changed. The existing Glasgow control room, acting with the central control room of the Central Electricity Authority, arranges generation so that at all times the most economical plant is running whether it be in England or in the South of Scotland.

Among the problems of the new Board is the fact that the central engineering staff of the C.E.A. in London is no longer available to carry out a proportion of the work involved in new construction, as it was formerly, and this places a heavier load on the construction staffs in Scotland and on their consultants. In this connection it may be noted that Messrs. Strain & Robertson were responsible for the recent additions to the Clyde's Mill station, Messrs. Merz & McLellan for the Braehead station and Messrs. Kennedy & Donkin for the new 60 MW sets at Portobello, this firm also being engaged for the new Kincardine station.

Barony is being dealt with directly by the Board's staff with the help of civil engineering consultants, Messrs. James Williamson & Partners.

With its progressive outlook, both technically and commercially, the South of Scotland Electricity Board is assured of a successful future. Its progress as an integrated authority responsible for all aspects of electricity production and supply will be watched with special interest in this country.

We are indebted to Mr. Pickles, the Board's chairman, for permission to make this survey and for the co-operation and assistance of the members of his staff in both Glasgow and in Edinburgh.

Not far from the new coalfields in Fife is this splendid example of Scottish mediaeval architecture, Falkland Palace, where James V of Scotland awaited news of his daughter Mary's birth

Society of Engineers

In his presidential address to the Society of Engineers Capt. H. F. Jackson, F.S.E., F.R.A.S., F.R.Met.S., dealt with the subject of "The Atom as a Source of Power," reviewing the discoveries that have led to our present knowledge of atomic structure.

Boiler and Turbo-Alternator Testing

SYSTEM ADOPTED AT C.E.A. POWER STATIONS

IN a paper presented before the Institution of Mechanical Engineers on 17th February, Mr. H. S. Horsman (Central Electricity Authority) described the system of testing boilers and turbo-alternators employed in C.E.A. power stations.

The objects of these tests were defined as demonstrating fulfilment of contractual guarantees and depreciation in performance with time, fixing merit-order in operation, advancing design, improving plant operation and fixing safety limits. Every new machine was subjected to the guarantee test in view of differences in performance of machines of the same designs. Official tests on thirty-three 30 MW machines between 1948 and 1955 showed an adjusted average heat rate (normal economic rating) of 10,050 B.Th.U/kWh with a standard deviation of 173 B.Th.U/kWh. Corresponding figures for thirty 60 MW sets were 9,307 and 155. For a few sets operating at higher steam conditions a heat rate of 8,800 B.Th.U/kWh had been obtained, which would be reduced to 7,800 B.Th.U. for some sets now planned.

In addition to measuring the heat rate at several selected loads, records of certain stage pressures and temperatures were kept for future routine tests and heat rates were established at one selected load at least but with a range of vacuum above and below that specified.

When machine readings pointed to an internal irregularity, a "routine" heat-rate test was applied and the results compared with the contractual tests; even if no corrective action were taken, the routine test helped to assess the merit order of the plant. The procedure was to bring the machine to routine standardised load and to adjust the vacuum to come within the range covered in the initial test.

Temporary speed rise test on loss of load (B.S. 132: 1951) (which must never exceed 15 per cent of normal) was carried out in stages on all new machines. Instantaneous speed rise should not cause the emergency trip to operate; the latter was set at 10 ± 1 per cent of normal speed, so that for satisfactory working the governor should hold the speed rise to less than 9 per cent.

Alternator Performance

The main criterion of alternator performance was low losses at rated output, speed and power factor without subtracting fan power or other auxiliary power. The air inlet temperature was obtained from a number of thermocouples arranged across the duct leading to the alternator cooling channels. Hydrogen-inlet temperatures were given by a thermocouple at the exit from each cooler. Stator-winding temperatures were measured by thermocouples embedded in the slot insulation during manufacture, but for core and tooth temperatures the thermocouples were fixed before the test began. Rotor winding temperature was calculated by the increase of resistance of copper on heating. In all heat tests, the alternator must first be run on load for several hours until graphical plots indicated temperatures constant within a degree or so.

Boiler testing techniques came under two principal headings, the direct and the indirect. The first measured the ratio of the useful or transmitted heat to the heat supplied by the fuel; the other measured the difference between the two, i.e. the losses. Heat transmitted was the product of the weight of feed water and the heat required to convert 1 lb of feed water into steam at test pressure and temperature. Heat input required determination of coal weight together with sampling, reduction and analysis.

With the increase in ash content the problem of a satisfactory determination of calorific value would remain for some time. The Central Electricity Authority still tested most boilers this way.

Indirect Method of Boiler Testing

In the indirect method the losses were measured and the percentage efficiency estimated by subtracting them from 100. Thus with an efficiency of 89 per cent the losses would be 11 per cent and the errors of the test were associated with the lower figure. This method dispensed with coal weighing and simplified laboratory work. The oxygen recorder (of which the Central Electricity Authority had several installations) had an advantage over the CO_2 recorder in that its reading increased with the quantity of excess air instead of being a complicated inverse function of the excess air.

The deferred efficiency test was introduced in agreement with the Watertube Boilermakers' Association to ascertain performance depreciation over a period, i.e. 2½ per cent within twelve months for a pulverised fuel boiler and 3 per cent within six months for a stoker-fired boiler. Particulars of the procedure for the two tests entailed were given.

Modern Boiler Plant Test Performance in C.E.A. Power Stations

Nature of firing	Pulverized fuel		Stoker	
Amount of dry ash in coal, per cent	Low, 10	High, 24	Low, 10	High, 24
Average radiated and unaccounted loss ($R + U$), per cent	1·4	1·4	2·1	2·1
Average dry gas loss, per cent	5·3	5·3	5·3	5·3
Average moisture and hydrogen loss, per cent	4·7	4·7	5·3	5·3
Average refuse loss, per cent	0·6	1·5	1·7	4·2
Average summation of losses, per cent	12·0	12·9	14·4	16·9
Average gross efficiency by difference, per cent	88·0	87·1	85·6	83·1
Suggested tolerance to cover departures from average performance, per cent	±0·6	±1·1	±1·0	±2·0
Endurance period between A and B tests, months	12		6	
Depreciation in endurance period, per cent	1·1		1·0	

Performance tests on 185 boilers (98 stoker and 87 pulverised-fuel) had been carried out since vesting day. The accompanying table referred to the indirect or loss method of testing modern C.E.A. boilers with average values of radiated and unaccountable losses.

Standardisation of water-flow metering for testing both boilers and turbo-alternators was discussed and reference was made to the five C.E.A. hydraulic calibrating laboratories under construction. For electrical metering, N.P.L. certificates had been obtained for a specially high grade of instrument. Possible improvements in electrical integrators were foreshadowed.

Pole-Changing Motors

Characteristics and Performance Discussed

OPENING the discussion on the three papers on pole-changing motors presented to the Institution of Electrical Engineers on 16th February and summarised in our last issue, Dr. W. J. Gibbs (B.T.H. Co.) said the papers suggested that there was a large unsatisfied demand for the 3 : 1 pole-changing motor. There was certainly a demand, though he did not know that it was a large one. However, the importance of these papers rested not on whether they met a crying demand so much as on whether—as they did—they contributed to knowledge and understanding. In the first paper the authors said that the need for constant-torque drives for providing a compromise magnetic circuit might necessitate a slight increase in frame size. Manufacturers' frame sizes worked in jumps; there was nothing slight about them in rating or in size. The striking feature about the paper by Rawcliffe and Jayawant was its preoccupation with crawling. This was a troublesome phenomenon, even in single-speed machines, and it was bound to be worse in pole-changing machines because most of the remedies had to be a compromise between the optimum values for the two pole numbers. He must therefore congratulate them on curing crawling troubles in their machine.

It was, he thought, correct that the single-winding machine would be cheaper than the two-winding type, but the advantage could be lost if the switching arrangements were complicated. It was unrealistic to equate the cost of a single-speed and a two-speed machine. It was not only on account of the frame size, because the two-speed motor would cost more for the same frame size. It was something to do with the way the minds of cost accountants worked. The slightest deviation from the norm, including omitting something, cost money, and it was very disheartening.

Mr. W. Hill (Metropolitan-Vickers) pointed out that high frequency losses could be as much as 4 to 10 per cent of total input. Hence, no great increase in size would be required in the two-winding machine if stray losses were taken into account. He drew attention to the cast-aluminium rotor with 30 per cent more rotor slots than stator slots used by Professor Rawcliffe and the copper rotor with insulated bars and slots which was probably used by the other authors, although this was not stated explicitly. Stray load losses and crawling torques would be absent, although the rotor slots exceeded the stator slots. The different braking arrangements were extremely interesting. With additional contacts the performance of a.c. braking could probably be equalled with a d.c. supply. Industry would be interested in the six-lead motor Professor Rawcliffe was about to produce, but unless the control gear arrangements were simpler he would have to pour some cold water on it. He hoped that this was the start of more investigation into induction motors and their applications. At present, problems were being faced without the help of textbooks and it was very difficult for manufacturers to make up their minds about what happened in these motors.

Professor F. C. Williams (Manchester University) called attention to the variable-speed induction motor he had described some time ago. This gave a uniform variable speed between limits, and the convenient limits turned out to be between 2 and 3 : 1 of continuous variation. This might be regarded as an interpolating mechanism between fixed speeds and the pole-changing system.

In his own machine it was found difficult to get enough copper into the stator and two windings would aggravate the difficulty. The authors had produced a scheme which enabled the winding space to be used more efficiently and gave less stator resistance, while still having the facility of the 3 : 1 change.

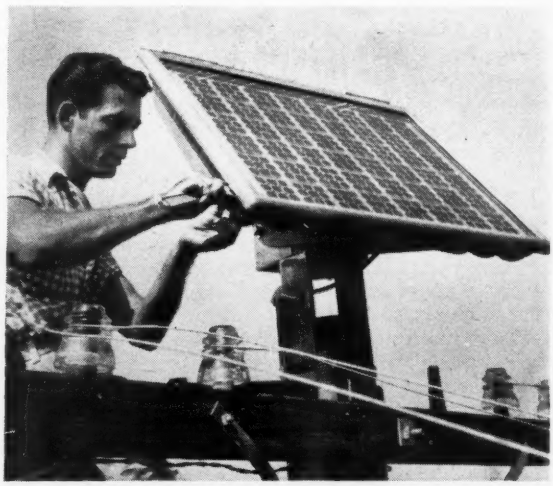
Mr. P. Huggins (Lancashire Dynamo & Crypto) said a point not without importance was the extent to which the new 3 : 1 pole-changing motor with its single winding would replace the conventional 3 : 1 speed-changing motor with two separate stator windings. Personally, he thought it might follow the same lines as the 2 : 1 pole-changing motor, where there was also a choice between one or two pole-changing stator windings. What might be termed single-phase injection braking was particularly interesting and might have some applications.

Professor J.E. Parton observed that this country had been accused, perhaps rightly, of being fruitful in ideas but lacking in bringing them to their proper technical conclusions. It was clear on this occasion that there had been close collaboration between the universities and the firms concerned. Theorists naturally asked whether there was a common underlying principle in all these ideas. In point of fact, there was; it was one in which different sequences were used on a very high phase number. On reading the papers he thought they did not fall in with the general theory of pole-changing, but on working it out he found that they did.

Mr. G. Redfern (Newman Industries) said that more remarkable than the coincidence of two papers on almost the same subject was the fact that the subject was the common induction motor or the changing pole version of it. Many people must welcome the revived interest at the universities in rotating machinery and the despised induction motor.

Mr. E. W. Krebs (consultant) thought the discussion had brought a sense of proportion to the comparison of the new 3 : 1 pole-changing motor and the orthodox type with two separate windings. The premise that there was no single-speed winding with a relatively low number of terminals in existence was not quite true, however. About twenty-five years ago he had developed a new type of pole-changing winding which required a total of twelve terminals and was suitable for all pole ratios, including 3 : 1. The criterion for any type of winding or was whether it stood the test of time. He hoped that in this case it would but he was not as optimistic as the authors.

Mr. J. E. Brown (Sheffield University) said that one merit of the Sheffield motor was that the torque/speed curve could be calculated not merely over the normal speed range, but when the machine was driving backwards, a range vital for the application of a.c. dynamic braking. One reason why industrial people showed so little interest in the latter was that they knew nothing about it.



Experimental installation of a solar battery on top of a telephone pole. The device, developed by the Bell Telephone Laboratories of America, uses discs of wafer-thin silicon about the size of a shilling. Small modules are electrically linked together to form a larger 432 cell solar battery. These silicon discs can deliver power at the rate of 100 W per square yard of surface and are effective even in a poor light

Transformer/Alternator Surges

Recent Investigations Described in I.E.E Papers

IT is now common practice to generate electricity with an alternator at about 11 kV and then to transform it up to 66 or 132 kV, the voltages at which the principal switching and distribution networks operate. This means that the majority of surges must pass through a transformer to reach the machine terminals. Very little has been published on the penetration of lightning surges through a transformer connected to an alternator, the majority of the literature dealing with either transformers or rotating machines. In view of this, considerable interest attaches to two papers by Dr. B. C. Robinson (C. A. Parsons & Co., Ltd.) which were presented at a Supply Section meeting of the Institution of Electrical Engineers in London last week. The first of these papers deals with the penetration of surge voltages through a transformer coupled to an alternator, while the second is concerned with the propagation of surge voltages through turbo-alternators with concentric-conductor type windings.

The first paper begins by pointing out that when considering the effect of transmission line lightning surges on a power station it is necessary to regard the transformer and alternator as a single unit. After a brief analysis of the phenomena likely to be produced when an impulse voltage is applied to a transformer coupled to an alternator, the results are confirmed by tests on three such units. These show that the most important voltage transference through the transformer is due to coupling between secondary winding and flux in the main core set up by the impulse current in the primary winding. This voltage may have an oscillatory or a dead-beat characteristic depending on the test conditions. In all experiments carried out the transferred voltage has been oscillatory with a dead-beat component.

Estimating Transferred Voltage

Three methods are mentioned in the paper for estimating the maximum value of the transferred voltage, varying from a simple assumption that the 50 c/s transformation ratio (line-to-line voltages) is valid to more complex formulae involving the various circuit constants. Comparison of the results obtained does not indicate an accuracy much better than about $\pm$ 50 per cent of the actual test value, although in most cases it is nearer $\pm$ 25 per cent. A high degree of accuracy cannot be expected, however, in view of the assumptions necessary to derive the formulae.

Voltage-distribution tests on an alternator connected to a transformer indicate that the transferred voltage is approximately linearly distributed, and thus there is little danger of interturn breakdowns occurring in the machine windings. These tests also show that the earthing of the alternator neutral point makes little difference to the alternator voltage distribution. This implies that protective circuits at the alternator neutral will also have no effect on the impulse voltage distribution.

A study of the effect of the power-frequency voltages on the surge voltages transferred through the transformer indicates that it may be necessary to add an additional 10 per cent of the transferred voltage in a typical case to allow for the effect of the alternating voltages.

In the second paper the study of the propagation of surge voltages in conventional types of alternator winding is modified to be applicable to the concentric-conductor type of winding used for some machines having a terminal voltage of 22 or 33 kV. The investigations described enabled an approximate equivalent circuit for the winding to be devised and analysed in a way which is not possible using the orthodox standing wave method of analysis for the study of surge voltages.

When a surge voltage reaches the machine terminals a set of travelling voltage waves is set up between each pair of adjacent conductors, each wave travelling with a velocity characteristic of the conductors and the intervening insulation or tube. The voltage wave between the outer conductor and the core has the lowest velocity, owing to the increased inductance produced by the iron. When a wave reaches the end of a section of the winding, reflection and refraction occur, inducing voltages, not only in the two sections or conductors concerned, but also in the corresponding point in the other conductors. Thus a voltage wave between the bull and inner conductors approaching the bull-inner link will, on reflection, set up waves at either side of this link and at the same time induce voltages at either side of the inner-outer link and at the neutral point. This causes the travelling-wave system to increase rapidly in complexity and to render any attempt to predict voltages theoretically extremely tedious if not impossible.

Machine Surge Impedance

The surge impedance of the machine tested was about 115 ohms, which compares with the figure of 125 ohms given previously for another machine which was tested without its rotor. Theoretical considerations indicate that if, as is now general practice, all the bull conductors had been connected in circuit, the surge impedance of the machine would have been lower. Unfortunately it has not been possible to confirm this experimentally.

The low value of the machine surge impedance compared with a transmission line will reduce by reflection the amplitude of any surge approaching the machine from an overhead line. Subsequent reflections may cause the voltage to increase, but since the voltage distribution in the machine becomes approximately linear after about 10 μ sec, the stresses produced will be fairly uniformly distributed in the machine.

In common with other large machines there is little possibility of damage from steep-fronted waves. In the concentric type the high capacitance between the various sections of the winding provides an efficient means of distributing the stress. In addition, the fact that the winding has a critical frequency of about 800 kc/s prevents any steep-fronted wave entering the winding.

The most effective form of surge protection for a machine of this type would appear to be a voltage-limiting type of surge arrester or gap which would prevent the machine terminal voltage reaching dangerous levels. From the tests it would appear that earthing of the neutral point does not appreciably affect the surge-voltage stresses in the machine. In the 25 years since the first machine of this type was installed, operating experience has not shown any breakdowns which can be attributed to surge voltages. This may be regarded as reliable evidence of the satisfactory nature of the general design.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication.
Responsibility cannot be accepted for the opinions expressed by correspondents.

Heat and Power Linkage

I WONDER if I may comment on the extremely interesting article on "Heat and Power Linkage" by Mr. Ungoed in your 17th February issue? The three Sankey diagrams on page 245 show clearly the amount of heat, or heat and electricity, which may be obtained from 100 tons of coal.

In the diagram relating to the boiler supplying low pressure steam for process, the efficiency would appear to be high. Eighty-two per cent would hardly be achieved over a period of time.

The evaporation of the boiler is 9.06 lb of steam per pound of coal. In the diagram of a combined boiler/back pressure turbine supplying process steam and electricity, it will be noticed that the amount of steam generated is less than that of the boiler supplying process steam only. That is, the evaporation is less in the combined boiler/back pressure case because of the higher initial steam pressure.

To be able to compare the two schemes it would be better to assume that in each case 2,030,000 lb of steam is required for process.

In the case of the l.p. boiler plant this would require 100 tons of coal. With the combined boiler/back pressure plant the coal required would be

$$\frac{2{,}030{,}000}{1{,}850{,}000} \times 100 = 109.7 \text{ tons of coal.}$$

The amount of electricity obtained would be

$$55{,}250 \times \frac{2{,}030{,}000}{1{,}850{,}000} = 60{,}609 \text{ kWh}$$

Hence to obtain the same amount of process steam in both cases, we should require 100 tons of coal with the l.p. boiler plant, and 109.7 tons with the combined plant, and generate 60,609 kWh.

If the cost of steam is assumed to be the same in both cases, then the cost of electricity generated in terms of the extra coal used amounts to 0.166d/kWh. There is, of course, the capital charge necessary for the turbine and electrical equipment on the top of that.

For the case quoted by Mr. Ungoed, the steam rate per kWh at 100 lb/sq in and 400 deg F is 33.5 lb. If the back pressure is lowered the amount of electricity per pound of steam will be increased. The lower the process pressure, the more advantageous back pressure operation becomes.

Space heating and processes requiring hot water might well require a back pressure of no more than 5 lb/sq in, at which the steam rate might be 20 lb/kWh.

With this steam rate, the 2,030,000 lb of steam would generate 101,500 kWh. With the same coal requirements, namely 109.7 tons, the cost of generating this 101,500 kWh would be 0.099d/kWh, assuming the price of coal in each case at 85s per ton.

The points about a combined boiler process steam are:—

(1) That for a given process steam requirement, the back pressure plant will consume a greater quantity of coal than a low pressure boiler plant.
(2) The lower the back pressure of steam the greater the electrical output for a given inlet pressure.
(3) That the capital costs of the turbine and electrical equipment must be added to the relatively low cost of production of electricity in terms of coal.
(4) Most important of all, there must be a close balance between the electrical and process steam requirements.

The straight electricity generation with a 29 per cent thermal efficiency shows up badly with 54 per cent of the heat rejected going to rivers or cooling towers. The difficulties of making use of this heat may be enormous, but in view of the fuel position, district heating, especially where power stations exist in densely populated areas ought to be seriously considered.

Glasgow. C. H. FIELDING, B.SC. TECH.

Nationalisation and Local Management

THE Herbert Report makes interesting reading to those who, like myself, were younger managers before the nationalisation of the supply industry.

I left it after five years of national ownership for the reasons which are so very obvious in the Report and returned to the real art of management, in private industry.

The recommendation to return distribution to local management, in its fullest sense, is so excellent that I for one would gladly return to this work. The difficulties are more apparent than real; I have met and overcome them several times before and a scrutiny of the roll of prevesting chiefs would find many who, like me, would welcome the opportunity of building up again that truly local organisation, whose reflection of the local mode of life was so important a part of our service.

B. E. E. M.

Incorporated Plant Engineers

The fourth annual dinner of the Incorporated Plant Engineers was held on 17th February at the Park Lane Hotel, London, and was attended by about 190 members and guests.

The toast of the Institution was proposed by Mr. John Gridley, chairman of the Mobil Oil Co., Ltd., who referred to the need for this country to preserve the balance of technologists in the population compared with other countries. He also spoke of the future needs of fuel oil in this country which were likely to amount to an increase of 15 million tons annually.

Mr. G. Sievewright, in responding for the Incorporated Plant Engineers, spoke of the importance of further education to practicising engineers and in particular to plant engineers. They were particularly proud of their own refresher courses for plant engineers and their annual conference.

The toast of the guests was proposed by Mr. D. Lacy-Hulbert, past president of the Institution, and Sir Ben Lockspeiser, secretary of the Department of Scientific and Industrial Research, who replied, declared that what the country needed was more specialists not fewer. He felt that the automatic computer had brought a new character to automatic machines which did make a considerable difference and should not be too easily discounted.

The maintenance function would become more and more important a part of management as the techniques of automatic production advanced and the emphasis would have to be on preventive maintenance. All this implied that plant engineers would have a more important role to play.

I.E.E. Annual Dinner

Duke of Edinburgh Becomes Honorary Member

THE Institution of Electrical Engineers held its annual dinner last week at Grosvenor House, London, more than 1,400 members and guests attending.

The President, Sir George Nelson, Bt., having extended a warm welcome to the principal guest, the Duke of Edinburgh, referred to His Highness's gracious acceptance of the invitation to become an Honorary Member of the Institution, which now numbered 40,000 members, and said it had given all members immense pleasure and encouragement, emphasising as it did his deep interest in the professions of science and technology whose work contributed to the improvement of the lot of mankind everywhere.

Sir George Nelson then presented the scroll of Honorary Membership of the Institution to the Duke of Edinburgh, who signed the Roll to the accompaniment of prolonged applause.

Country's Dependence on Engineers

In proposing the toast of " The Institution of Electrical Engineers," the Duke of Edinburgh thanked the President and assured him that he fully appreciated what a great honour it was for a layman to be made an Honorary Member.

The scope for engineers of all sorts in all parts of the world was almost unlimited, he said, but the competition was extremely keen, and unless this country could keep up with other countries, our services would no longer be required. On the other hand, if this country got ahead of its rivals, the prospect was really bright.

It was well known and well recognised that this country was short of engineering students of all kinds, and unless the Institution could do something about it, the pinch would be felt with increasing pain in the years ahead.

Probably one of the outstanding contributions of electrical engineering to the country's economy had been the very considerable increase in the efficiency with which fuel resources were being converted into power. Power in any quantity from nuclear sources was still a long way off, and in the meantime it was necessary to make the best use of dwindling coal and imported oil. Waste in the days when fuel was cheap and plentiful was perhaps understandable; but to-day it was inexcusable. The electrical engineering industry was also helping the economy of the country by its very large share of the export trade and by making it possible for all other industries to increase their productivity.

" I am also glad to see that the Institution encourages research " continued the Duke of Edinburgh. " I think many people look upon research as something that might help a conjuror to produce an elephant out of his hat instead of a rabbit! It does sometimes, but most of the time it is helping the conjuror to produce a bigger and better rabbit out of a smaller and cheaper hat." His Royal Highness pointed out by way of example that smaller and lighter radio and electronic equipment in aircraft meant more payload, and as more and more electrical equipment became necessary in aircraft or in ships, so its weight and bulk had somehow to be reduced.

Stating that it would be a sad day if the Institution ever became a mutual admiration society, the Duke pointed out that although it had no direct responsibility to industry, the Institution had a direct responsibility through its activities and through its members to the community as a whole, and it rested with the Institution to ensure that all products of British electrical engineering were the best in the world.

Sir George Nelson handing the Honorary Membership scroll to the Duke of Edinburgh

Fuel and Raw Materials

The President, in response, said that millions of people to-day took for granted the benefits of electric power and did not fully realise that its generation was steadily bringing about the exhaustion of fossil fuels such as coal and oil. It was really bad economics to burn oil and coal, but it was the best available in the past before atomic power came in sight, and that development must now be urged on with all speed. The Institution had formed with the other Institutions concerned a permanent organisation to co-ordinate their efforts in pressing on that vital development.

Although nuclear energy would provide an alternative to fossil fuels, our scientists would also have to find substitutes for many other basic materials which were being consumed at an ever-increasing rate as the standard of living of the people of the world advanced. Those developments demanded an increase in the numbers of the scientists and engineers required in the future to develop and to bring into production those essential new sources of energy and of raw materials. The responsibility for producing that increased supply must be borne by the universities and colleges of technology in collaboration with industry through appropriate changes in elementary and secondary schools. The necessary resources to fulfil that great responsibility must be provided immediately.

Boards of study must not for one moment consider that their responsibility was limited to producing men trained in science and engineering. They must go much further and establish courses that would produce men who had also acquired an awareness of their responsibilities to the

community, and whose powers of judgment and initiative were adequate for their tasks.

" Not only must we ensure an adequate supply of trained men," continued the President, " but we must also ensure that when they enter research establishments and industry, the most efficient use is made of their services and that their efforts are not inhibited by administrative defects." In fields under the control of Government Departments much waste of technical man-hours arose through the application of the annual budgeting system to long-term projects of development and production. Also in industry, in answer to calls for more competition, there was developing the multiplication of technical effort on developments of a similar nature. Competition was undoubtedly good in principle, but not if it reached the stage where it caused waste of scientific and technical resources.

The toast to the guests was proposed by Mr. J. Eccles, C.B.E., B.Sc., Immediate Past-President, and Sir Cyril Hinshelwood, M.A., D.Sc., F.R.S., President of the Royal Society, responded.

Electricity Supply in Europe

IN a publication of 132 pages, EL (55)8, the Organisation for European Economic Co-operation, Paris, has published a second edition of " Electricity Supply Industry in Europe," the first of which appeared in January, 1955. The present report contains four parts. The first two, dealing with the present position and the future prospects of the industry, are each divided into five sections relating to the general outline, equipment, production, power exchange and consumption. Part 3 is concerned with some economic aspects, trends of production costs and prices, power exchange and new or under-exploited sources of energy such as cheap hydro, tidal energy and nuclear energy. Part 4 discusses aspects of international co-operation.

During 1954 consumption in the seventeen member countries rose to 328,000 million kWh, an increase of 9·5 per cent over the previous year, and during the first half of 1955 consumption was 179,000 million kWh, a rise of 10 per cent on the same period in 1954. No sign of saturation in electricity demand can yet be seen.

During 1955 investment in production and distribution plant amounted to the equivalent of $2,500 million, or about 7 per cent of the gross capital expenditure of the member countries of O.E.E.C. An intensification of investment effort will be needed in the next few years as the total installed capacity of 90 million kW at the beginning of 1955 should reach 120 million kW in 1960.

Thermal capacity is increasing at a slightly greater rate than hydro capacity, as most of the more economically workable hydro resources have already been exploited, and most European countries appear to be strengthening their thermal system deliberately as an insurance against the possibility of years of low rainfall. It is estimated that about 27 per cent of the hydro power potential has been utilised.

Power exchange between member countries was greater in 1954 than in 1955 and amounted to 5,700 million kWh, compared with 4,700 million kWh, German imports accounting for the actual increase which took place.

Electricity consumption has increased at a slightly lower rate for industrial than for household uses and, on average, consumption per head in Europe rose from 887 kWh in 1950 to 1,164 in 1954 (figures for the U.S.A. are 2,582 and 3,393 kWh). Although some countries of Europe have very high figures for consumption per head the actual level is largely influenced by the development of certain industries, especially the electro-chemical and electro-metallurgical industries. Consumption by railways is increasing by about 6·9 per cent per annum.

In considering the future prospects of the electricity supply industry it is stated that, of an average annual rate of increase of consumption of 7 per cent (equal to a doubling every ten years), 4 per cent has been due to the tendency for electricity to extend its range of use and the remainder to an increase in the volume of industrial activity, each change of 1 per cent in which is reflected by a change in the same direction of 0·6 per cent in electrical power consumption.

The average efficiency of production in thermal stations over the area covered was 23·3 per cent in 1954 and is expected to rise to 25·5 per cent in 1960. The highest thermal efficiency obtained at present is that of 36·6 per cent at the natural gas fired station at Tavazzano in Italy, but a thermal efficiency of 38 per cent is planned for a new station in Germany.

An analysis is made of some factors affecting tariffs and it is noted that there is a tendency in several Continental countries toward a change in existing two-part tariffs to the favour of consumers with long utilisation periods.

Both France and Great Britain are planning nuclear reactors for power production, based for some years on the conversion of uranium into plutonium. After this it seems possible that the plutonium could be used to produce thermal energy on a large scale. The indications everywhere are, however, that a genuine progressive replacement of traditional generating plant will not begin until 1970 or 1975. An examination of all cost estimates so far prepared indicates that prices for generation from nuclear plant are already competitive.

Servo-Mechanism Control

AN on-off servo-mechanism with predicted change over was described by Messrs. J. P. Coales and A. R. M. Noton on 14th February to the Institution of Electrical Engineers' Measurements Section. The probable saving of up to half the torque by association with a high-speed analogue repetitive analogue computer was demonstrated in the case of a 10 kW control system, for which responses to step, ramp and parabolic input functions compared favourably with those of an orthodox system. Additions required to the computer to simulate complicated motor, load and torque characteristics were shown to be insignificant. The more powerful the control system the more important was the saving in torque (apart from the elimination of power amplifiers), justifying the complications of the associated electronics.

Nuclear Engineering

AT a technical meeting of the Combustion Engineering Association on 15th February Dr. J. E. Littlechild (United Kingdom Atomic Energy Authority) gave a talk on the application of atomic energy to heat and power generation. After discussing the effect of the C.E.A. programme as a means of progressively easing the coal situation, he explained the general principles of nuclear fission and the potentialities of the various designs of reactors with different moderators and coolants now in the research stage. The lecturer gave particulars of the full-scale graphite-moderated CO_2-cooled units at Calder Hall and also touched upon the possibility of building small reactors for providing heat for industrial purposes. Earlier in the day Mr. G. S. Ransom described the elaborate system of work study in use at the numerous works of Imperial Chemical Industries, Ltd.

VIEWS on the NEWS

By REFLECTOR

THE "easy payment" stamps introduced experimentally by the North Western Electricity Board in 1952 have met with such success that I wonder the system is not more widely adopted. In about 3½ years well over four million stamps have been sold, to the value of more than half a million pounds and I imagine that sales will be further boosted now that the Board is installing stamp machines at nine of its Service Centres. Besides helping consumers by enabling them to spread the cost of their electricity bills without incurring the extra prepayment meter charge, the scheme must also be attractive to the Board. The cost of meter collections is avoided and a steady flow of revenue is obtained in advance of the meter readings.

* * *

Some words and phrases are done to death by the popular Press. Everybody will recall "target" as one of them; it is still used but not so frequently as it was. To-day, as I have said before, "blue print" has taken its place to some extent and is employed in some funny ways. The latest addition to my collection is from the *Evening Standard* which said the other day that "Lord Chandos, boss of the Associated Electrical Industries giant is blueprinting another big expansion in Northern Ireland." The note went on to say that Lord Chandos was studying reports from two directors just back from Ulster and ended up: "All part, no doubt, of the whispered £25 million switch-on."

* * *

A note in a recent issue of the *Electrical Review* referred to a lamp price list which a lamp manufacturer had produced in Welsh and which it was claimed was the first to be printed in that language. I hear, however, that Cryselco, Ltd., issued price lists in Welsh as far back as 1937 and 1938; it would be interesting to know whether these were the first in the field.

* * *

Some interesting demonstrations of the commercial applications of ultrasonic energy (high frequency vibrations beyond the range of human hearing) were given at an informal evening of the Radio and Telecommunication Section of the Institution of Electrical Engineers on 20th February. This is, to me, a most fascinating subject. Mr. C. F. Brockelsby explained how ultrasonic waves could be used to "see into" solid objects and so test them for internal flaws, and measure their thickness and other physical properties without causing damage. High power ultrasonic waves, which could agitate liquids so violently that artificial cold mists and fountains were produced, could get inside intricately engineered parts and products such as electricity supply meters, and remove otherwise inaccessible dirt, grease, and swarf. The process of electroplating could be improved by similar means. Hard and brittle materials—glass, tungsten carbide, tool steels, even diamonds—could be drilled or shaped by percussion machining at ultrasonic frequencies. Enormous local stresses and strains could be produced in metal test specimens by ultrasonic waves. Fatigue testing could be carried out rapidly. In a demonstration a metal rod was made red hot and finally broken by ultrasonic energy.

* * *

A small town in Gloucestershire is among the first in the country to become "atomic energy minded." At Berkeley, where the Central Electricity Authority is to build one of its first nuclear power stations, an exhibition was recently held to show how the station will work and to allay any fears that it will involve danger to the local residents. Mr. J. Eccles, the Authority's deputy chairman (operations), observed that it was "probably not too much to say that here in this place during the next few years we hope to see the inauguration of a new era that will mean prosperity for Berkeley, for Gloucestershire and for Great Britain as a whole." Certainly without atomic power the outlook would be grim indeed, for as Mr. Eccles pointed out not only are we faced with a shortage of coal but world oil reserves are also rapidly being used up.

* * *

The *Evening Argus* (Brighton) recently published the following mysterious letter:—

> "The explanation of the water in the electric light bulb that Mr. Palmer seeks might well solve my particular problem, for the circumstances are similar.
>
> After the first fall of snow, the water taps in my house started to glow, giving a light equal to that of many lamps. I then found that my electric light bulbs had water in them, complete with goldfish swimming around.
>
> My great concern is to know how to swop over the taps with the lamps, and, since the latter are sealed, how to feed the wretched goldfish?"

Unfortunately I missed Mr. Palmer's contribution which might have shed some light on the matter.

* * *

Last month has been described as the coldest February on record, but as the meteorologists have pointed out arctic weather during that month is not uncommon. Looking through the *Electrical Review* of seventy years ago I found in the 5th March, 1886, issue, a report by Mr. R. E. Hulton, of the Northern Telephone Company, in which he spoke of the weather during the preceding ten days as being "of a totally unexampled description" and went on:

> "The oldest inhabitant, even with his usually elastic imagination, is unable to grapple with the occasion and can rake nothing out of the dusty corners of his memory of the bad old times that will at all compare with the present state of things. It is perhaps early to boast yet, but with about 3 feet of snow on the ground it is probable that the worst is over, and therefore it is very satisfactory and reassuring to the managerial mind to have no reports of broken wires, even on the trunk routes, where the wires are exposed to the full strength of the storm."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At the recent annual general meeting of the British Synchronous Clock Conference, **Mr. H. A. Knox** (Magneta Time Co., Ltd.), and **Mr. F. W. Burgess** (Synchronome Co., Ltd.), were elected chairman and vice-chairman respectively.

The Export Credits Guarantee Department announces the retirement at the end of March of **Mr. G. A. Fitch,** C.B.E., director of its Medium Term Underwriting Division. He will be succeeded as director of this Division by **Mr. J. J. G. Smith,** at present director of the General Division.

Mr. C. O. Boyse, B.Sc.(Eng.), M.I.C.E., M.I.E.E., Fel.A.I.E.E., who, as we reported in our last issue, has been appointed a director of British Insulated Callender's Cables Ltd., was educated at Whitgift School, Croydon, and at London University. In 1924 he joined the Overhead Department of the former Callender's Cable and Construction Co., Ltd., and his early work included twelve months in India engaged on the electrification of suburban railway lines at Bombay. He was placed in charge of Callender's Overhead Line Design Department in 1929, and in 1942 he became manager of the Civil Engineering Department, in which capacity he was responsible for all overhead line construction work.

Mr. C. O. Boyse

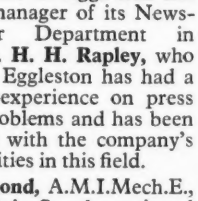
After British Insulated Cables, Ltd., and Callender's Cable and Construction Co., Ltd., amalgamated to form the present B.I.C.C. in 1945, Mr. Boyse was appointed chief civil engineer to the new company with responsibility for the direction of all business for overhead lines, railway electrification, radio structures, etc. In January, 1949, all B.I.C.C.'s construction work was transferred to its newly formed subsidiary company, British Insulated Callender's Construction Co., Ltd., and Mr. Boyse was appointed director and general manager of that organization, which offices he still holds.

Mr. Boyse was chairman of the Transmission Section of the Institution of Electrical Engineers in 1948, when the Section was increased in scope and renamed the Supply Section. He and a colleague were awarded the John Snell Premium as joint authors of "The Problem of Conductor Sagging on Overhead Transmission Lines," a paper read before the I.E.E. Transmission Section in 1943. At present he is associated with work on overhead line regulations, a British Standard Code of Practice for overhead lines, and wind power generation. He serves on various committees of the British Standards Institution and the Electrical Research Association, and is a member of the Conférence Internationale des Grands Réseaux Electriques.

The Igranic Electric Co., Ltd., announces that **Mr. C. Eggleston** has been appointed manager of its Newspaper Conveyor Department in succession to **Mr. H. H. Rapley,** who has retired. Mr. Eggleston has had a long and varied experience on press room conveyor problems and has been closely connected with the company's expansion of activities in this field.

Mr. E. A. Dymond, A.M.I.Mech.E., A.M.I.E.E., A.F.R.Ae.S., who resigned from the board of Sangamo Weston, Ltd., and left this country in January last year for a tour of Canada and the United States, has now been appointed vice-president and general manager of Sangamo Generators, Inc., Springfield, Illinois, which is is a subsidiary of the Sangamo Electric Co.

Mr. C. R. Marshall, M.I.E.E., M.I.B.A.E., northern superintendent, Northmet Sub-Area, Eastern Electricity Board, has retired from the Board's service. Born in Gillingham, Mr. Marshall was educated at the Mathematics School, Rochester, and trained at Finsbury Technical College. After serving as assistant engineer with the Borough of Gillingham and later with the Kent Electric Power Co. and Grays Thurrock U.D.C. Electricity Department, Mr. Marshall joined the North Metropolitan Electric Power Supply Co. at St. Albans in 1912 as assistant engineer. During the 1914-18 war he was commissioned in the Royal Engineers and served in Mesopotamia until 1919 when he rejoined the Northmet Company and served as senior assistant engineer, Enfield. Later that year he resigned and joined the Bombay Electric Supply & Tramway Co. as mains engineer. Mr. Marshall rejoined Northmet in 1923 as resident engineer, Chingford, later becoming resident engineer, Hertford, and in 1937 became superintendent, Northern Area. He is the co-author of various agricultural books and publications and has also served on the Codes of Practice Sub-Committee of the I.E.E., various E.D.A. Committees, and is at present district chairman of the newly formed Hertfordshire District of the I.E.E.



Mr. C. R. Marshall

The Metropolitan-Vickers Electrical Co., Ltd., has appointed **Mr. G. F. Clark,** B.Sc., as assistant superintendent, Steel Products Department, as from 1st February. Mr. Clark obtained his B.Sc. at Edinburgh University and started with Metropolitan-Vickers as a college apprentice in 1946. Since 1948 he has been engaged as a production engineer in the Steel Products Department, first at Trafford Park and later at the Stockton Works, being appointed chief production engineer of the Department in 1951.

Mr. G. F. Clark

Wilkins & Mitchell, Ltd. ("Servis" electric washing machines), Service Department, announces that **Mr. E. Laycock** has been appointed service training instructor, service headquarters, Tame Bridge, Walsall, and that **Mr. R. Dudley** has been appointed depot manager, Wolverhampton service depot.

Mr. F. H. Mann, M.I.E.E., who since relinquishing his position as H.M. Senior Electrical Inspector of Factories has held the position of electrical adviser to the Home Office, is in addition now retained in a consulting capacity by the Fire Protection Association.

Mr. A. J. Minns, chairman and managing director of Watson & Sons (Electro-Medical), Ltd., has left this country by air for a six weeks' tour of West Africa, South Africa, East Africa and the Sudan.

Mr. C. W. Hotchen has been appointed works manager (production) at the factory of Smiths Aircraft Instruments, Ltd., Cheltenham. Mr. Hotchen served his apprenticeship at the Royal Ordnance Factory, Woolwich, from 1929 to 1934. He then went to Negretti & Zambra, Ltd., as a junior technical assistant and was assistant technical manager when he left in 1948 to join the Plessey Co., Ltd., as chief engineer of the com-

ponents division. In 1950 he joined the aviation division of S. Smith & Sons (England) Ltd., as assistant works manager.

Mr. J. Denys Johnson has been appointed a director of the Tube Investments' subsidiary, the Simplex Electric Co., Ltd., Oldbury and Blyth Bridge, Staffs. He will also continue in his present capacity in the company as commercial manager, Simplex Division.

Mr. J. D. Johnson

The Minister of Fuel and Power has reappointed **Mr. C. R. Heathcock,** F.C.I.S., of Stourbridge, and **Mr. J. McDowall,** of Sutton Coldfield, as part-time members of the Midlands Electricity Board.

Dr. D. T. A. Townend, Director-General of the British Coal Utilisation Research Association, was the guest speaker at last week's luncheon of the **Batti-Wallahs' Society.** Last year Dr. Townend went to Australia at the request of the Australian Government and during his stay visited most of the Australian coalfields. His talk was mainly concerned with the potentialities of these fields and he illustrated his talk with a number of excellent lantern slides. A vote of thanks to him was proposed by Mr. R. H. Gummer. Mr. T. C. F. Bigland (the " Mate ") reminded members that the annual general meeting would be held on 6th March and asked them to notify him as early as possible of the names of their guests for the ladies' night on 16th March. The next luncheon will be held on Wednesday, 28th March, when the speaker will be Mr. T. Worth.

Mr. G. H. Tilbrook, A.M.I.E.E., has been appointed sub-area engineer for the Suffolk Sub-Area of the Eastern Electricity Board with effect from 1st March. Mr. Tilbrook, who before nationalisation held a senior position in the Engineering Department of the East Anglian Electric Supply Co., Ltd., has for many years been closely associated with the development of electricity supplies in East Anglia, and since nationalisation has held the position of planning and development engineer for the Suffolk Sub-Area.

Mr. G. H. Tilbrook

Mr. E. Irwin, for nineteen years national officer of the Electrical Trades Union, is retiring from office on reaching the age limit. Before being elected national officer he was for a number of years a member of the Executive Council of the Union. As a national officer, he specialised in Air Ministry, Admiralty and Civil Aviation affairs.

Mr. J. R. Waller, C.G.I.A., A.M.I.E.E., chief electrical engineer of the Amalgamated Press, Ltd., has recently been awarded the Insignia Award of the City and Guilds of London Institute. He joined Amalgamated Press in 1935 after training with the British Thomson-Houston Co., Ltd., Rugby. During the war he was commissioned in R.E.M.E., and was mentioned in despatches. He has visited the United States and Canada in addition to the Continent on behalf of his company since 1946.

Mr. Walter M. Lippmann, managing director of F. B. Lippmann & Son Pty., Ltd., electrical merchants and importers of Melbourne, Australia, is visiting this country and expects to be in London from 22nd March until 25th April. During his visit Mr. Lippmann hopes to establish new agencies in the various lines in which his company and its associated companies are interested. His address in London will be c/o Australia and New Zealand Bank, Ltd., 6, Albemarle Street, London, W.1.

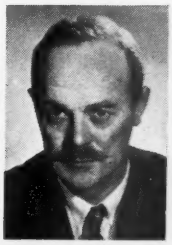
Mr. N. H. T. Turner is leaving the Plymouth depot of W. T. Henley's Telegraph Works Co., Ltd., and is going overseas to join the Henley Co. in South Africa. **Mr. P. Massey** has been appointed Henley's local representative in Plymouth, and he will be in charge of the depot. Mr. Massey started with Henley's at the head office in 1937, and has subsequently had many years of experience in the company's Rubber Cable Sales Division.

At a recent informal ceremony in Marconi House, Mr. G. N. Gabell, secretary of the English Electric Co., Ltd., made a presentation to **Mr. J. E. Williams,** until recently assistant secretary, who retired in December last after thirty-six years' service. He is continuing in an advisory capacity for the time being. The presentation — which had been delayed owing to an accident to Mr. Williams just before his retirement—took the form of a travelling case and a cheque, to which a large number of well-wishers throughout the English Electric organisation subscribed.

Mr. Gabell (right) making the presentation to Mr. Williams. Also in the group are (left to right) Mr. E. A. Wade, Mrs. J. F. Stuart, Mr. W. E. Woolon, and Mr. G. E. Shaddock (behind Mr. Gabell)

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr. E. Cowin** has relinquished his position as assistant superintendent of the company's Motor Department and has been seconded to Metropolitan-Vickers—Beyer, Peacock, Ltd., as general manager, Stockton Works, as from 1st January. **Mr. G. R. M. Thomson,** B.Sc.(Eng.), has been appointed to succeed him as assistant superintendent of the M-V Motor Department from 16th January.

Mr. E. Cowin



Mr. G. R. M. Thomson

Mr. Cowin joined Metropolitan-Vickers (then British Westinghouse) in 1916, becoming foreman of the commutator and brushgear section of the Motor Department in 1935. In 1946 he was appointed assistant superintendent, Motor Department and Press Shop, having been responsible for the replanning of these departments in the Mosley Road Works when the latter was converted after the war from aircraft assembly to electric motor manufacture.

Mr. Thomson, after serving as a lieutenant in the R.N.V.R. from 1942 to 1946, took his B.Sc.(Eng.) degree at St. Andrews University. On completing a college apprenticeship course with M-V he became senior development engineer at the company's

Leonard Works, being transferred to the Motor Department as manufacturing assistant in 1955.

Mr. K. Taylor, Associate M.C.T., A.M.I.E.E., acting assistant electric traction engineer, Chief Mechanical and Electrical Engineer's Department, British Railways (London Midland Region), Manchester, has been appointed electric traction engineer, London Midland electrified lines, Manchester (London Road) Station. Mr. Taylor received his technical education at the Manchester College of Technology, and entered the service of the former London and North Eastern Railway in 1935; he served his apprenticeship at Gorton locomotive works. In 1944 he was transferred to the Chief Electrical Engineer's Department at King's Cross, London, as technical assistant, and in 1950 was appointed assistant engineer for erection (substations and cables) for the Manchester-Sheffield-Wath electrification scheme. In the following year Mr. Taylor was made substation and track engineer at Penistone, responsible for maintenance of substations, cables, and overhead line equipment for Stage I of the electrification scheme, and later was appointed distribution engineer to the electric traction engineer at Manchester. In his new position he will be responsible for the Manchester-Bury and Manchester-Altrincham electric lines.

The annual dinner of **E. Dawson (Lamp Factors), Ltd.,** was held on 17th February at "The Old Bell Hotel," Holborn, London, W.C.2. Among those who attended were Lt.-Col. C. H. Blackburn and Mr. A. H. Body, directors of the company.

OBITUARY

Mr. J. E. L. Blythe, one of the three founder-directors of the Airedale Electrical & Mfg. Co., Ltd., died on 13th February. Mr. Blythe, who was sixty-seven years of age, was previously connected with the British Engine Boiler & Insurance Co., Ltd., the Lancashire Dynamo Co., Ltd., and the British Westinghouse Co.

Mr. A. C. Eden, B.Sc., M.I.E.E., engineer, Fens Sub-Area, Eastern Electricity Board, died on 25th February at the age of fifty-four. Mr. Eden was educated at Bristol University and received his training with the Metropolitan-Vickers Electrical Co., Ltd. He was with the Yorkshire Electric Power Co. from 1925 to 1930 when he took up the position of mains engineer with the Mid-Cheshire Electric Supply Co. From 1946 to vesting date he was distribution engineer with the Mersey Power Co. and the Mid-Cheshire Co., after which he became assistant engineer in the No. 2 Sub-Area, Merseyside and North Wales Electricity Board. He had been engineer in the Fens Sub-Area since 1949.

DYNAMO AND MOTOR MANUFACTURERS

The annual dinner of the Associated Dynamo and Motor Manufacturers took place on 21st February at the Trocadero Restaurant, London. Mr. F. H. Schroeder presided and welcomed the guests. He referred to a successful year which had enabled the members to continue actively in research and development so essential to their future.

Sir Percy Mills, the principal guest, recalled that this industry had not always enjoyed prosperity and that it was only by getting together that they had succeeded in benefiting themselves and their employees. He hoped that no new legislation would create difficulties for the industry. The evening concluded with light entertainment and a reunion of members.

ATOMIC ENERGY GROUP

A new group for atomic work is announced by Vickers, Ltd. The group consists of Vickers, Ltd., Rolls-Royce, Ltd., and Foster Wheeler, Ltd. The first task will be the application of nuclear energy to marine propulsion. Application has been made for the registration of a subsidiary company to be called Vickers Nuclear Engineering, Ltd. The object of the formation of this company is the control of policy within the Vickers Group of engineering development in the atomic field. The first directors will be Sir Ronald Weeks, Lord Hives, Major-General C. A. L. Dunphie and Mr. G. H. Hopewell. Rear-Admiral L. E. Rebbeck has joined the staff of the Vickers Group and will be in executive charge of the project.

A.E.I. REACTOR

In the House of Commons last week Mr. Warbey asked the Lord Privy Seal if he would state the terms of the arrangement between the Atomic Energy Authority and Associated Electrical Industries, Ltd., whereby A.E.I. was to construct a 5,000 kW privately-owned nuclear reactor and would receive a supply of nuclear fuel for its operation.

Mr. R. A. Butler said that the company proposed to construct this reactor as a private venture. The Atomic Energy Authority would supply the necessary nuclear fuel on a rental basis. The terms of the loan of the nuclear fuel would cover the cost of fabricating the fuel elements; a percentage of the total cost of the fuel, including an element for research and development; the cost of fuels spent during the running of the reactor; and the cost of reprocessing spent fuel elements. He hoped his answer would indicate that the terms were being very carefully watched.

In answer to Mr. Maclay, Mr. Butler said that not only had the company been patriotic in this matter, but it intended to make the reactor available for educational research work by a group of southern universities.

Mr. Callaghan said there was some anxiety about the terms of the arrangements and asked if a White Paper could be published giving full details.

Mr. Butler: As the transaction in question is inspired by the utmost public spirit, I can see no objection whatever to making available to the House all the information which I have. I will consult the Lord President of the Council about the best way of doing this.

INVERGARRY STATION

The North of Scotland Hydro-Electric Board has brought into commission the Invergarry power station in Inverness-shire. This station, which will produce about 82 million kWh in a year of average rainfall, is the lower station of the Board's Glen Garry scheme. It is alongside the main Fort William-Inverness road and is mostly underground, only the top of the stone building being visible. The 20,000 kW water turbine operates under the very high head for a Kaplan type machine of 175ft. The electrical and mechanical consultants are Messrs. Kennedy & Donkin and the turbo-alternator was made by the English Electric Co., Ltd.

CLEAN AIR BILL

The Government was condemned by Labour M.P.s for not showing a sense of urgency in the proposals to end air pollution when the House of Commons Committee considering the Clean Air Bill resumed its discussions. But the Government's spokesmen replied that the recommendations of the Beaver Committee were being followed in providing that there should be a period of grace of seven years during which it would be a defence to prove that the emission of dark smoke from a chimney was due to the nature of a building or its equipment, and that it had not been practicable to alter or equip the building properly. An Opposition amendment to reduce this period to three years was negatived by 19 votes to 16.

In the course of the debate Mr. Enoch Powell, Parliamentary Secretary, Ministry of Housing and Local Government, announced that the appointed day, after which it would be an offence to permit the emission of dark smoke from the chimney of any building, would be early in 1958.

R.E.A.L. Watertight Fitting

We regret that the illustration of the R.E.A.L. non-corrodible watertight fitting in the advertisement announcement by Rowlands Electrical Accessories, Ltd., in our last week's issue, page 97, was printed upside down.

Financial Section

STOCKS and SHARES

LETTERS were expected to go out this week-end to the stockholders of Associated Electrical Industries with the offer of new ordinary shares, in the proportion of one new for every three old shares held, at a price of 57s 6d. Some £24 million new money is involved in the transaction. Also, during the past month, the electrical markets began dealing in new ordinary shares issued by the Plessey, Decca and Broadcast Relay Service companies, amounting together to about £4¾ million. In other sections of the industrial market, the credit squeeze has caused companies similarly to brave market conditions as inclement as February's weather in order to finance their urgent capital requirements. In sum, these demands on capital must be supplementing quite substantially the increase in Bank Rate and the Government's other disinflationary actions as a damper on Stock Exchange prices.

English Electric

In view of the large amounts of capital being raised by other firms in the electrical industries, English Electric's full accounts and balance-sheet have been scrutinised in particular for evidence to show whether or not this company is also likely to reappear in the new issue lists. On the whole, market opinion seems to have satisfied itself that the position renders unlikely an early operation, but indicates the need for more permanent capital at a later stage, and a continuance of conservative dividend policies meanwhile. Approximately £11 million was raised by the "rights" issue of last September, when bank indebtedness was reported to total £13·4 million. In the accounts now published, overdrafts are shown to be down to £10·3 million (including those of the Canadian subsidiary). More light on the subject will be forthcoming no doubt at the annual meeting to be held on 15th March.

Dividend and Earnings

As already known from the preliminary profits statement, profits of the English Electric group expanded during 1955 from £2·1 to £2·8 million (after tax). From the full accounts now available it is deduced that the new acquisitions of Vulcan Foundry and Robert Stephenson accounted for a substantial share of the increase. Ordinary dividends totalling 12½ per cent (as before) involve the distribution of a million, so that the payment is covered 2¼ times. During the past year, turnover increased by some 20 per cent, and more than £5 million was spent on plant and equipment. Outstanding contracts for further capital expenditure at the end of the year exceeded £3 million, while total assets of the group are shown in the balance-sheet to be already within easy reach of the £100 million mark. At the time of the issue of the annual report, English Electric £1 shares stood at 51s 6d., on which basis the yield is not much short of 5 per cent.

Plessey Issue

Early transactions in the Plessey Company's new 10s ordinary shares took place at premiums of around 8s on the price of 50s at which they are offered, by way of rights, to shareholders. Later, the premium hardened to 10s, a figure which will remind shareholders of their right to apply for "excess" shares in addition to their provisional allotments. When the issue was announced, it will be recalled, the company reported a continuation of satisfactory results since the beginning of the current financial year in July, and the expectation of dividends totalling 30 (against the previous total of 27½) per cent in the absence of any material change in conditions during the remainder of the period. The new shares will participate in both the interim and final payments. As a result of this issue the company will have £2 million new money for further expansion.

Decca Capital

Decca Record are raising about £1½ million new capital by a "rights" offer of 1¼ million new 4s "A" (non-voting) ordinary shares to existing stockholders at a price of 17s 6d. Early on, the new shares were quoted at premiums rising from 7s to 8s 9d, with the old "A" shares at an ex-rights price of 26s 3d. Payment for the former is due in full by 23rd March; they will be entitled to participate in dividends for 1955-56, and are transferable free of stamp duty for the time being. Proceeds of the issue are to go towards the reduction of the overdraft, the financing of capital commitments and the provision of more working capital.

Decca's financial year ends with this month, so that after reviewing the 1954-55 results at the recent annual meeting the chairman was in a position to report, also, on progress during the first three quarters of the current period. In this time, he says, output of the group has shown an increase of £2·4 million, or 35 per cent, over that of the previous year. All sections of the business have contributed to the expansion, and special mention is made of progress in the field of radar and the Navigator. In the light of the figures to date, the directors are confident about the results for the current year, and expect that the dividend, on capital increased by the new issue, will be at least maintained at the latest level. Assuming then a distribution of 1s 9d per share (43¾ per cent) the prospective yield, on the basis of a price of 26s 3d for the "A" shares, is not less than 6⅔ per cent.

Recent Dividends

A further material expansion in earnings during 1955 enables Desoutter Brothers (Holdings) to raise the total ordinary payment from 25 to 30 per cent, which still involves the distribution of less than a quarter of the available surplus. Despite a heavier tax change, the net figure is up from £228,000 to £280,000. This is the third successive improvement in the shareholders' return. The Mather & Platt dividend of 15 per cent for last year represents an increase of a fraction over 1 per cent on the previous distribution, part of which was paid on smaller capital. Although trading profits show a small reduction, the net profit after tax is higher at £943,000, which represents earnings of 47½ per cent on the issued ordinary stock, and thus covers the payment comfortably three times over.

Preference Shares

Last year's events did little to improve the popularity of preference shares, in general, as a form of investment. Under pressure from the tighter and dearer money policy, and the depression in gilt-edged securities, most of the principal industrial issues lost about 15 per cent of their value over the twelve months, while in many instances the ordinary shares of the same companies were adding something to theirs. The 6½ per cent preference shares of English Electric and G.E.C., for example, declined from 28s 9d to the neighbourhood of 24s; the 6 per cent issues of Crompton Parkinson and B.I.C.C. from 26s 3d to around 22s 6d. Meanwhile, of course, the purchasing power of the fixed rates of dividend shrank further. Towards the end of 1955, however, investors were showing signs of becoming better disposed towards this type of security, which has put up a stiffer resistance to the subsequent course of events than many ordinary shares have been able to do.

The decline in the value of preference shares has reached the point at which a buyer of many first-rate issues obtains a return in the region of 5½ to 5¾ per cent on his money. That has been the position for instance, in the case of the four stocks mentioned in the note above, which stood recently at about one to two shillings below their end-1955 prices. For purposes of comparison, the yield from War Loan has lately been around 4·8 per cent, and from many top class industrial ordinary shares somewhere between 5 and 5½ per cent.

We hope next week to resume publication of our share lists, which have had to be omitted for several weeks in consequence of the dispute in the printing trade.

REPORTS and DIVIDENDS

Berry's Electric, Ltd., is being converted into a public company with a capital of £375,000 divided into £175,000 6½ per cent cumulative redeemable preference shares of £1 each and 800,000 ordinary shares of 5s each. Full particulars will be advertised on 5th March and dealings are expected to commence on 8th March. It is expected that the bulk of the preference shares will be placed at par and a small proportion of the ordinary shares at 5s 7½d to yield, on the proposed 10 per cent dividend, £8 17s 9d per cent. The placing is sponsored by Robert Fraser & Partners, Ltd. The brokers are W. I. Carr, Sons & Co.

International Combustion Africa, Ltd., reports a trading profit for the year ended 30th September last of £298,400, as compared with £323,849 for 1953-54, and after providing £91,377 for taxation, the net profit is £192,202 (against £217,407). General reserve again receives £100,000 and it is proposed to pay a final ordinary dividend of 25 per cent making 40 per cent for the year (unchanged). The balance carried forward is £44,744 (against £40,792 brought in).

Desoutter Brothers (Holdings), Ltd.—The group profit for the year ended 31st December last, after providing £270,180 for taxation, is £279,788, as compared with £228,321 for the preceding year. General reserve receives £200,000 and it is proposed to pay a final dividend of 10½d on the 5s ordinary shares, making a total of 1s 6d per share for the year (30 per cent). For the previous year the total distribution was 25 per cent. The balance carried forward is £147,111 (against £127,495 brought in).

Waygood-Otis, Ltd.—The profit for 1955, including income from investments, is £492,628, as compared with £451,334 for 1954. It is proposed to pay a final dividend of 14 per cent on capital increased by a three-for-two scrip issue. An interim dividend of 40 per cent was paid on the smaller capital. For 1954 the total distribution on the old capital was 75 per cent.

Vactric, Ltd., is making scrip issues of four new 5s "A" (non-voting) ordinary shares and one 6 per cent £1 cumulative preference share for every eight ordinary shares held. The "A" ordinary shares will rank for the current year's dividend and the preference shares as from 31st March next.

Hoover, Ltd.—The group profit for 1955 is £3,838,233, as compared with £4,581,961 for the preceding year. Taxation requires £1,674,285, leaving a net balance of £2,005,069 (against £2,350,208), of which £1,942,353 is attributable to Hoover, Ltd. It is proposed to pay a final dividend of 40 per cent on the combined ordinary and "A" ordinary capital, making 50 per cent for the year. Last December the board stated that it hoped to recommend a final dividend of between 50 and 60 per cent. The profit for the year has come out very close to the board's estimate, but in view of the year's trading conditions and the recent statement by the Chancellor of the Exchequer it considers it prudent to pay a final dividend of 40 per cent.

The Plessey Co., Ltd.—At an extraordinary meeting held on 20th February resolutions were passed increasing the capital to £2,450,000 by the creation of a further 800,000 ordinary shares of 10s each. As reported in our issue of 17th February, the new shares are being issued to ordinary shareholders at 50s per share in the proportion of one new share for every two held.

The Midland Electric Manufacturing Co., Ltd., reports net profits for 1955 of £231,465 as compared with £203,392 for 1954, after deducting taxation of £243,100. It is proposed to pay an ordinary dividend for the year of 12½ per cent (against 10 per cent).

Parmiter, Hope & Sugden, Ltd., have declared an interim dividend of 7½ per cent (unchanged).

Bankruptcies

R. G. K. Dale and **W. B. Martin,** electrical contractors, lately carrying on business together as "Martindale" at 77, Meneage Street, Helston, Cornwall.—Last day for receiving proofs for dividend 3rd March. Trustee, Mr. C. M. C. Hancock, 12, Princes Street, Truro, Official Receiver.

G. W. Altass, 1, Bruce Avenue, Shepperton, Middx., electrical engineer, described in the receiving order as electrical engineer and general contractor.—Order made 13th December, 1955, granting immediate discharge subject to consent judgment for the sum of £2,200 and for £1 10s costs of judgment, payable by instalments of £200 forthwith and balance by quarterly instalments of £250, the first instalment of £250 to be paid on 26th March next.

E. T. M. Marshall, radio engineer, formerly carrying on business at High Street, Hurstpierpoint, Sussex, under the style of G.E.M. Radio Electric, as a radio and electrical dealer.—Last day for receiving proofs for dividend 7th March. Trustee, Mr. E. C. Sherwood, 8, Old Steine, Brighton, 1, Official Receiver.

W. L. Wright, 3, Uredale Place, Ashby, Scunthorpe, late of Red Lion Corner Shop, Caistor, late radio, television and electrical engineer, now journeyman electrician.—Receiving order made 8th February on debtor's own petition. Public examination 12th April at the Town Hall, Grimsby.

A. C. Payne, 40, Springfield Road, Wickersley, Rotherham, formerly carrying on business at that address as electrical contractor.—Application for discharge to be heard on 15th March at the County Court Hall, Bank Street, Sheffield.

H. Brown, 14, Abbey Drive, Luton, and lately carrying on business at 109A, Park Street, Luton, radio and electrical engineer.—Trustee, Mr. C. A. Taylor, 6, The Parade, Northampton, Official Receiver, released 2nd February.

Liquidations

Hartley Sharp & Co., Ltd., electrical manufacturers and merchants.—Winding up voluntarily. Liquidator, Mr. W. J. Becker, 53, Snakes Lane, Woodford Green, Essex, appointed 4th February.

China & Japan Telephone & Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. W. Sarson, 5, London Wall Buildings, Finsbury Circus, London, E.C.2, appointed 7th February.

Ambrose & Albrow, Ltd., electrical contractors.—Winding up voluntarily. Liquidator, Mr. L. Bull, 45, High Street, Sittingbourne, appointed 7th February.

TRADE MARKS

Applications have been made for the registration of the following trade marks. Objections may be entered up to 8th March:—

MVC (design). No. B745,201. Class 7. Electric, magnetic and electro-magnetically operated valves for use in pipe line systems or as parts of machines. MVC (design). No. B745,202. Class 9. Electric, magnetic, electro-magnetic and thermostatically operated valves, all for use in the automatic control of temperature, humidity or pressure of oil, water, gas or air.—Magnetic Valve Co., Ltd., 28, St. James's Place, London, S.W.1.

KAL. No. B740,393. Class 9. Electronic apparatus; radio, radar, television, telephone, telegraphic and transmission measuring apparatus; overload protection devices; apparatus for measuring and detecting radio-active substances; and electric apparatus for automatically regulating pressure, temperature and speed, etc.—Kelly Acoustics, Ltd., 295, Regents Park Road, N.3.

STANOFONE. No. 743,503. Class 9. Instruments and apparatus for use in telephony.—Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

WIMA. No. 744,380. Class 9. Electrical condensers. — W. Westermann, Germany. Address for service, c/o Lloyd Wise, Bouly & Haig, 10, New Court, Lincoln's Inn, W.C.2.

TRANSAMP. No. 745,880. Class 9. Sound amplifiers, sound recording and sound reproducing instruments, and component parts.—Lustraphone, Ltd., St. George's Works, Regents Park Road, London, N.W.1.

LUMIFRACTOR. No. 745,388. Class 11. Lighting installations and parts and fittings.—Holophane, Ltd., Holophane House, Elverton Street, Vincent Square, London, S.W.1.

TROPICATOR. No. 747,382. Class 11. Electrically heated cabinets for propagating plants.—C. B. McAllan (Engineers), Ltd., 295, Regent Street, London, W.1.

PARAFILM. No. 741,104. Class 17. Electrical insulation identification tape.—Lindsay & Williams, Ltd., 1121, Ashton Old Road, Manchester, 11.

Progress in Manufacture

Activities of the Brush Group in 1955

THE development programme by the Government of the United Provinces, India, for the Mirzapur District resulted in two orders for Brush Export, Ltd. Generating equipment was installed in a cement factory at Churk and power station plant ordered consisted of three Brush-Ljungstrom turbo-alternators, each of 2,400 kW, a number of switchboards, transformers and motors. Also received was a contract for the supply and installation of equipment for the new power station at Chopan, near Mirzapur. The equipment includes two 3,000 kW Brush-Ljungstrom turbo-alternators, generating at 6,600 V, 50 c/s. This station will in addition contain Brush high voltage and low voltage switchboards.

Cochabamba, Bolivia, has awarded Brush Export a contract for large extensions to its existing power station. Each of the three generating sets will comprise a B4AU8 pressure-charged diesel engine, manufactured by the National Gas and Oil Engine Co., Ltd., coupled to a Brush 1,150 kW, alternator, generating at 10 kV.

Other overseas power stations equipped last year in partnership with Mirrlees, Bickerton & Day, Ltd., another of the group's oil engine companies, included Port Louis, Mauritius, where two Mirrlees pressure-charged diesel engines, each directly coupled to a Brush 1,742 kW alternator, and two Mirrlees pressure-charged diesel engines with air intercoolers, each directly coupled to a Brush 1,968 kW alternator, were installed; Lyallpur, West Pakistan, involving six Mirrlees engines, direct-coupled to Brush 1,242 kW alternators; Siddhirgunj, East Pakistan, with nine Mirrlees engines coupled to Brush 1,468 kW alternators, complete with ancillary equipment; and Arica, Chile, having three Mirrlees engines, direct-coupled to Brush 1,000 kW alternators controlled by Brush 6,600 V switchgear.

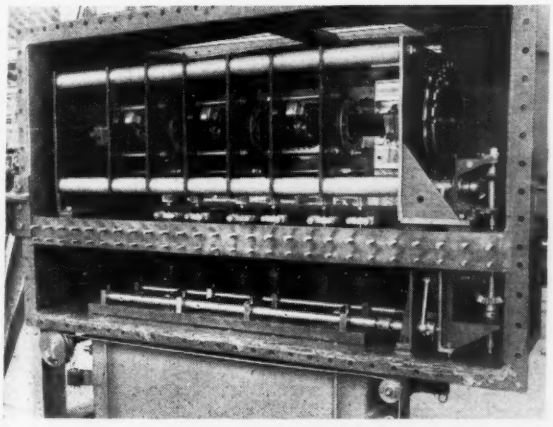
Brush was also in partnership with Mirrlees in equipping Ashford "B" power station for the Central Electricity Authority. The five sets installed each comprise a Mirrlees KVSS12 engine direct-coupled to a Brush 2,000 kW alternator. Ashford "B" is the largest diesel station to be operated by the C.E.A. and the largest post-war diesel station in the British Isles.

An interesting order was for four "Square Path" self-exciting, self-regulating alternators, of 7·5 kVA each, for the British Geophysical Expedition to the Antarctic.

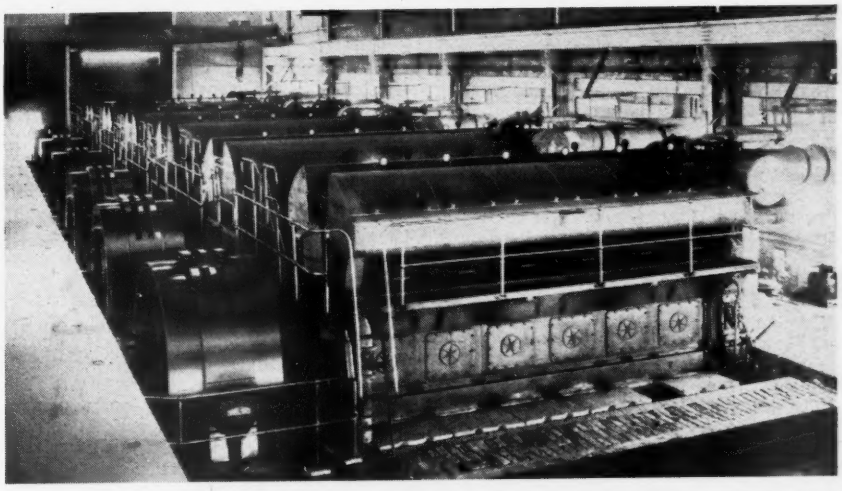
The largest order placed with Brush Traction, Ltd., was for twenty 1,250 h.p. locomotives for the British Transport Commission. Designated type A1A-A1A, they are designed for a maximum safe speed of 75 m.p.h. for main-line passenger and freight services. Each is powered by a Mirrlees engine coupled to a Brush generator with a continuous output of 828 kW. Traction motors, control gear and superstructure were also manufactured by Brush Electrical Engineering Co., Ltd.

The Steel Company of Wales received or ordered a total of 19 diesel electric shunting locomotives during 1955. Last year also saw the completion of an order for 25 diesel-electric 1,000 h.p. main line locomotives for the Ceylon Government Railway.

New products introduced by the Brush Electrical Engineering Co. included VBA switchgear suitable for use on three-phase systems earthed to permit the use of standard circuit-breakers in accordance with clause 20 of B.S. 116/1952. The gear was designed to meet present



Above: General view of Brush 33 kV, 400 A, three-phase reactor type on-load tap change gear



Right: Six Mirrlees engines direct coupled to Brush alternators and developing 1,242 kW each, at Lyallpur power station, Pakistan

day requirements of Area Boards and industrial users for switchgear equipment to be operated on 11 kV and 6·6 kV systems and with a fault level up to 250 MVA.

The company also began to manufacture its own "on load" tap change gear for three-phase power and regulating transformers. Manufacture of the larger sizes of high voltage transformers was increased. Greater production was made much easier by the introduction of a new technique for drying and processing, by which the transformer core and coils are placed in a circulating air oven and dried with air dehydrated with activated alumina. Subsequent impregnation is with degassed oil to remove the air from the windings.

FERGUSON, PAILIN, LTD.

THIS company's outstanding technical achievement during the year was the introduction of a bulk-oil circuit-breaker (type XOPR60) with a rating at 132 kV of 5,000 MVA. Considerable progress has also been made with 275 kV isolator construction and isolators of this type are being manufactured for the Central Electricity Authority.

Among the home contracts secured was one for the Kintore substation of the North of Scotland Hydro-Electric Board, for which switchgear and ancillary equipment worth nearly a quarter million pounds is to be supplied. This will include switchgear of 132 kV and 33 kV ratings. Completion of the Kirkby substation (North West, Mersey and North Wales Division, C.E.A.) has been accompanied by extensions to numerous existing 132 kV substations, including Connah's Quay and Carmarthen Bay; additional air-blast circuit-breakers have been installed in the latter substation, whilst orders for further units have been received and are in process of manufacture.

The installation of the 132 kV section of the Penwortham substation was completed, and the manufacture of equipment commenced for the adjoining 275 kV section. Bulk-oil circuit-breakers of the type XOPR60, for 132 kV service, were manufactured for the Shin substation, North of Scotland Hydro-Electric Board.

From overseas, orders received included a large contract for the territory of H.H. The Ruler of Kuwait for ten 11 kV switchboards of 250, 350 and 500 MVA ratings. Further large orders for 11 kV 250 MVA air insulated metalclad equipment were received for the Karachi area of West Pakistan, and for 50 similar ring-main units from the West Punjab.

The company was also successful in obtaining orders from Middle East markets against severe competition, including one for fifty 6·6 kV 250 MVA ring-main units and substation switchboards for Cairo.

Deliveries to Australia figured prominently in activities of the year, during which ten 132 kV 3,500 MVA bulk-oil circuit-breakers of the pneumatically operated type were shipped to New South Wales and a 17-panel double busbar 11 kV 500 MVA switchboard to Queensland. In Europe, orders were received from Greece for 22 kV 750 MVA indoor and outdoor substation switchgear and for 6·6 kV 250 MVA switchboards.

Electricity Generation and the Mines

THE impact of mining policy on the generation of electricity by the Central Electricity Authority is the subject of a paper by Mr. J. D. Peattie published recently in the *Mining Electrical & Mechanical Engineer*. The author showed that in every country the demand for electricity was doubling roughly every ten years without any real sign of saturation whether, as in Canada, 3,500 kWh was used (1950) per head per annum or, as in Greece, 83 kWh.

Coal used for electricity generation yearly in Britain amounted to over 40 million tons out of a total home consumption of 220 tons. Imports from U.S.A. and Europe were now at the rate of 120,000 tons/week for power stations out of a total of 900,000 tons. Imported oil fuel would be increasingly used for dual firing; it was now a main fuel only at Bankside power station. Allocations from individual coalfields were changing profoundly and those in the East Midlands were of growing importance. Generally it was cheaper in Britain to transmit electricity at 275 kV over more than 60 miles than to send the equivalent amount of coal by rail. Sea transport was cheaper than either, but required rail transport at one or both ends. The 275 kV transmission lines from the Midlands to London and North West England were designed for later conversion to 380 kV.

Much of the new plant in the Midlands was being sited on the River Trent. The latest station awaiting Ministerial consent was High Marnham, which would burn 3 million tons of coal per annum. It would contain five 200 MW sets, each with one 1,400 k lb/hr boiler; steam conditions would be 2,350 lb/sq in and 1,050 deg F with reheat at 1,000 deg F. Cooling towers would be installed.

New plant used pulverised fuel almost entirely and could therefore accept a much wider range of fuels than mechanical stokers, which were limited to boilers of about 300 k lb/hr. The design of p.f. boilers depended, however, on the volatile content of the coal. Inert content, which increased from under 20 per cent in 1939 to nearly 25 per cent in 1953, the dry ash portion rising from 11 to 16 per cent, was also important. Such constituents as sulphur or chlorides of sodium, potassium and calcium might cause severe fouling of heating surfaces, more especially with stoker firing.

The one slag-tap boiler of the C.E.A. was difficult to operate on the loads available. A boiler under construction would employ cyclone firing which, it was hoped, would yield slag having a market value and reduce the cost of dealing with flue dust. The best method of getting rid of sulphurous gases was considered by the C.E.A. to be by having the chimneys at least 300ft high. The Authority was also experimenting with gas washing by an ammoniacal liquor, the supplies of which, however, were only enough to treat the gas from 6 million tons of coal.

The present coal price structure and transport charges made it more economical than it was in the earlier post-war years to use unwashed coal at stations near the pits, where (unlike nuclear stations) they would tend more and more to be situated. Even now, the average haul for inland transport had fallen from 37·2 miles in 1946 to 33·7 miles in 1953. An accurate reassessment of the comparative costs of fuel treatment by the coal and electricity supply industries was overdue. On the side of the coal industry its advantages lay in avoiding the costs of bringing ash to the pithead, removing various proportions of it there and of disposing of rejected material. On the electricity supply side were savings in costs of transporting ash to the power stations, of additional fuel-handling plant, boilers and auxiliary equipment, of ash handling and disposal and of higher operating costs due to the lowering of boiler efficiency.

The South of Scotland Board was building at Barony in Ayrshire a 60 MW power station to use local slurry. The novel features were the fuel handling and milling plant, the remainder of the station being of normal design. There seemed to be a good chance, however, that normal pulverised fuel fired generating stations near the coalfields could turn the available slurry into electricity as economically as any other grade.

INDUSTRY AND THE HOUSE

By A. M. F. PALMER, A.M.I.E.E., M.P.

ELECTRICITY supply has had a lot of critical attention recently from the parliamentary questioners. The Herbert Committee Report and a brisk exchange of raking fire in the normally staid correspondence columns of *The Times* have much assisted this development. For instance, Mr. Gresham Cooke, the new Conservative Member for Twickenham, who has enlisted himself apparently as a light-weight recruit in Mr. Nabarro's old-established guerilla campaign against nationalised electricity, asked the Minister of Fuel and Power to issue a general direction to the Central Electricity Authority forbidding it "to offer hire purchase facilities subsidised by its other operations." Also he demanded to know what action the Minister was taking to compel the C.E.A. to consult Electricity Boards before conceding wage claims—an obvious reference to *l'affaire* Randall. But it could hardly be said that Mr. Cooke received satisfaction from his Minister in either case. On hire purchase Mr. Jones pointed out that the Electricity Boards (not the C.E.A. of course) had established by mutual agreement fair trading between themselves and the private contractors and did not charge costs incurred in retail trade activities to electricity supply. Also, the Herbert Committee had made what Mr. Jones thought was a "sensible suggestion" for the future; that separate accounts should be published for retail trading and general activities.

On the more important matter perhaps of wage and salary negotiations, Mr. Jones remarked that the statutory negotiating machinery had on the employers' side not only representatives of the Central Authority, but of the Area Boards as well. It was not his intention to interfere in matters which he considered were best left to free discussion between employers and employed. However, not content with this obviously cautious Ministerial answer, Mr. Cooke was bold enough to refer in a supplementary directly to the correspondence in *The Times* and thus brought on his head the unexpectedly sharp retort that the chairman of the London Electricity Board had been told of the Minister's "severest displeasure" that the Press should be resorted to for exchanges of this kind. This answer delighted Opposition Members as much as it confounded the ranks behind Mr. Jones.

Chancellor's Speech

The major interest of the House of Commons at the time of writing is the full-scale debate on the economic situation following on the Chancellor of the Exchequer's announcement. This, given to surprisingly full benches on the previous Friday, had provided plenty of scope for Labour week-end speakers to denounce the Government for alleged mismanagement of the country's affairs.

A crowded Monday House waited for Mr. Macmillan to open by moving a motion affirming the confidence of the House in his proposed remedial measures. The Chancellor was generally conciliatory in his approach and tried to damp down in advance controversy between the parties. He contended that in the same way as every Government in turn had vainly struggled with the problem of unemployment in pre-war days the two parties since the war had found the problems of full employment nearly as difficult. Yet, said Mr. Macmillan, he would rather face a boom than a slump and he would never be a party to the artificial creation of unemployment. People were better off and knew it. The trouble was that they were acting as if they were just a bit better off than the country could afford.

Defending the capital cuts in the nationalised industries, the hire purchase restrictions and the further reduction of subsidies, Mr. Macmillan admitted these things would be a disappointment to many and might even result in some temporary dislocation of trade and industry. But they should be looked on as part of a campaign in which all must take part. To pick and choose, accepting that which was liked and avoiding that which was disliked, would be to fail. In fighting inflation the Government were defending full employment; if they did not succeed the one would ruin the other.

Although Mr. Harold Wilson, for the Opposition, started in an orthodox enough manner by complaining that the Chancellor's speech had been profoundly disappointing, as he proceeded it became more and more evident that the former President of the Board of Trade was making no routine dispatch box effort. Whatever their opinions on this occasion, few could have failed to admire his powers of analysis and argument.

Mr. Wilson said there had been three crisis statements and two Budgets within a year. With a change of Chancellor it might have been supposed that there would now be a halt in the policies of the last four years. But all there had been was a shift of metaphor. Instead of "pruning the roses" and "blowing off the froth" the new Chancellor had resorted to the homely phrases of the electrician such as "blowing fuses" and "pulling out plugs here and there." Yet practical things went on growing worse all the time.

"Stagnation of Exports"

The first stark fact was that the state of the country's gold and dollar reserves was serious. These had fallen by 30 per cent since June, 1954, and were lower than when the Government took office. In exports, gold and dollar earnings and production Britain was nearly at "the bottom of the league" compared with other countries. Mr. Wilson contended that the stagnation of exports was the net result of the Government's "free-for-all" inflated economy. Going on to outline some of his own remedies, Mr. Wilson would not agree that import licensing would lead to allocation and domestic rationing and asked what would be the industrial consequences of the Chancellor's latest announcement? It was no good talking about a "marginal effect" on the cost of living index. If Mr. Macmillan was really trying to combine higher living costs with some pressure on industry to make it more difficult to pay higher wages, then all was set for the worst industrial strife the country would ever have known. The Opposition accepted the Chancellor's assurance that he would not be a party to the creation of unemployment, but they were afraid that with these very words on his lips he would "walk backwards into unemployment" because of his obsession with purely monetary methods.

In connection with the capital cuts in electricity supply the Minister of Fuel and Power had earlier at question time surprised the House by his assurance that rural electrification stood in no danger of curtailment. It seems likely that there will be further questioning on this and related points very soon, because it is not possible surely to reduce electrification projects generally by millions of pounds without something going somewhere?

Economic Policy

Government's Measures Against Inflation Debated

IN the House of Commons debate on the Government's measures to combat inflation, Mr. Harold Macmillan, the Chancellor of the Exchequer, said he was very grateful to the nationalised industries for the co-operation they had shown in reducing their programmes of capital expenditure in 1956-57.

He said the programmes had already been revised downwards before submission, as the result of the requests made by Mr. Butler when he was Chancellor. However, as the result of a further reassessment of priorities, the nationalised industries had undertaken further to reduce their proposed capital expenditure in 1956 by about £50 million in all. The stiffening of hire purchase terms, a further restraint on local authority investment, and the raising of the Bank Rate represented a cut of several hundreds of millions of pounds.

He explained that the restrictions on consumer credit were being further increased for the simple reason that consumer demand was still excessive. The extension of the control to capital goods was a new feature. The reason was that the excess of investment demand was now plain for all to see and the nation could not afford to let it be inflated yet further by credit from this source. He knew that his proposals would be a disappointment to many people and that they would result in some temporary dislocation of trade and industry, but he was sure that they would be understood as a part of a campaign in which everyone must take a part. It was vital for us to force more goods into the export market.

Production and Exports

Mr. Harold Wilson, who pointed out that last year the trade gap worsened by about £300 million, questioned whether the Chancellor could really claim that the credit squeeze was having its reputed effect of restraining imports and expanding exports. Although the House welcomed the meagre successes of the Board of Trade in expanding exports—they were still slowly rising—if one compared our export record with those of other countries one could see how dismal was the Government's performance. It was the same gloomy record in regard to production. From 1951 to mid-1955, the production in Germany rose by 54 per cent, Austria 40 per cent, Holland, 39 per cent, Italy 31 per cent, France 26 per cent, and the United Kingdom 16 per cent. Why had exports stagnated? It was not that the markets were not there. It was a direct result of the Government's free-for-all, unplanned and inflated economy. In cutting down investments they were getting immediate relief by mortgaging the future.

Mr. Wilson said that the Opposition believed that the inessential must be sacrificed for the essential and that resources should be deployed on the things that the country most needed.

Industrial Re-equipment Vital

Mr. Hervey Rhodes said it was foolish that there should be a credit squeeze when it was vital to re-equip industry with first-class machines. If we could not do that, the prospect of automation was gone.

Mr. Douglas Glover said that he had no ill feelings over nationalisation, but he thought that in the nationalised boards, particularly in the electrical industry, there was much lax administration, particularly on the retail side, and waste.

Mr. George Darling said that there were about 76 different wage rates for various classes of work in the engineering industry. It was a terribly old-fashioned wages structure, but the employers, not the unions, were opposing a new wages system.

Mr. Frederick Lee considered that the need for the correct type of capital investment was greater now than ever before. Automation was going rapidly ahead in the United States and Russia but at this critical phase the Government was enforcing more tightly a credit squeeze which had already failed dismally in its objective.

Sir Ian Horobin described the nationalised industries as "enormous, self-contained, almost syndicalised empires, able to make nonsense of any Government's financial programme although acting with the best of motives." Was it not time that they devoted the best brains from both sides of the House to the really vital problems, including especially that of building into the nationalised industries more effective financial control, so that they no longer had the present position in which, as the Herbert Report pointed out so well, even the Central Electricity Authority was not in a position to exercise control, let alone the Minister when a problem comes to him?

Coal Industry Investment

Sir E. Boyle, Economic Secretary, Treasury, emphasised that the Government were making no reduction in productive investment in the coal industry. He saw recently the new tinplate plant at Trostre and no one who had visited it could fail to be impressed by the fact that the second industrial revolution was dominated by electronics. It was the tremendous growth in electronics and electrical development which constituted the revolution.

He said that the hire purchase restrictions had not attracted much attention and he thought the House considered it reasonable to put an extra curb on this type of borrowing. The sharpest increase in hire purchase dealings included goods such as television sets and washing machines which were pressing on the same resources as were needed for investment goods and for exports.

Capt. Charles Waterhouse thought that if coal production could be increased by 20 million tons, which he did not think impossible, the whole economic problem would be altered. He appealed for a determined effort to get improved output. He did not think it true that there had been a great inflow of luxury goods, but there had been a great increase in imports of manufactured goods. Imports of non-electrical machinery from the United States increased by 34 per cent last year, and electrical machinery by 100 per cent. The President of the Board of Trade should review this matter.

Sir Robert Boothby said that to increase exports by repressing industrial development at home was a policy of desperation.

Mr. H. A. Price condemned the unofficial practices of trade unionists, usually locally operated without recognition by shop stewards, and referred particularly to the London Electricity Board. Of course, this was an abuse of nationalisation, he said, but were the nationalised industries the only ones in which it occurred? Only a small proportion of workers were really doing their best.

Mr. Eric Fletcher said he hoped the Government's cuts would not affect the promised plans for expanding technical and scientific education at a time when great advances were being made in education and in developing electronics by nations with whom we were competing.

Mr. Peter Thorneycroft, President of the Board of Trade, replying to the debate, said that it was no part of the Government's policy to cut back expenditure on technological education. Few matters could be urged as being of greater importance. The increased imports coming into Britain were needed to meet the solid demand of expanding industry. There was misunderstanding about "manufactured goods." These were not small consumer goods but the essential materials and semi-raw materials of industry—machinery, metal goods and the like.

PARLIAMENTARY REPORT

In the House of Commons Mr. Frederick Lee asked the Minister of Labour what progress had been made towards the setting up of a committee of inquiry, containing trade union representation, to assess the technical, economic, and social problems raised by automation. He complained that Britain was lagging behind other countries in examining this subject.

Mr. Iain Macleod said he would like to wait for the Department of Scientific and Industrial Research report on this subject, which he understood would soon be available, before deciding what action might be necessary.

Monopolies Report on Electrical Plant

Mr. Albu asked the President of the Board of Trade when he expected to receive the report of the Monopolies Commission on Heavy Electrical Plant. He was informed that the President expected to receive this report about the middle of this year.

Minister and L.E.B. Chairman

Mr. Gresham Cooke asked the Minister of Fuel and Power if he would issue a general direction to the Central Electricity Authority to consult local Electricity Boards before conceding wage claims.

Mr. Aubrey Jones declined to do so, saying that under the Electricity Act, 1947, it was for the C.E.A. and appropriate organisations of workers to establish and maintain machinery for settling terms and conditions of employment. The Authority had in practice consulted with the Area Boards in this matter, as the statute required, and the negotiating machinery established in consequence ensured that the employers' side of the appropriate joint council included representatives of the Areas as well as of the Central Authority.

Mr. Cooke asked if the Minister seen the letter from Mr. Randall, the chairman of the London Electricity Board, alleging that the Electricity Boards were not consulted, that the C.E.A. was one of the ringleaders in the inflationary spiral, and that the wages situation would be much more under control if the local electricity boards were consulted.

Mr. Aubrey Jones said he had seen the correspondence and had asked Mr. Randall whether he thought there was some defect in the existing wage negotiations machinery. Mr. Randall conveyed to him his view that there was indeed no defect. "For my part, I accepted that assurance and I indicated to him my severest displeasure that he should, in the first instance, have indicated his views in the correspondence columns of *The Times* rather than directly to me," said the Minister, adding "Further, I cannot but deprecate that a difference of views between two appointees of mine should be ventilated in the Press rather than in other ways."

In reply to Mr. George Brown, Mr. Jones said that the relationship of the Minister to the nationalised undertakings was certainly a rather intangible and delicate one. But one thing he was perfectly certain about: that the Minister ought not interfere in wage negotiations without the gravest possible cause, or endeavour to influence a nationalised undertaking either to concession or to resistance.

When Dame Irene Ward wished to ask a question on Mr. Randall's behalf the Speaker said he thought that the question had been completely exhausted; if Dame Ward had another point to raise, she should put down another question.

Windmill Generators

In answer to Mr. Harold Neal, Mr. Jones said his Department was sponsoring a programme of research, which the Electrical Research Association was carrying out at its Cranfield station, into the possibilities of generating electricity by wind power on a commercial scale. The Department had also been contributing towards the cost of testing two large experimental windmills in other parts of the country.

Mr. Neal asked if the Minister had formed an opinion whether this experiment had been financially worth while. Had it developed to such a stage that we might offer this as a going concern to our territories overseas where they had no natural fuel resources?

Mr. Jones thought the experiment had been going for sufficiently long to enable them to conclude that the likely contribution to coal economy was small—no more than between two and five million tons a year.

Cuts in Capital Expenditure

Lt.-Col. Lipton said there were rows of privately-owned houses in Brixton where the people were still waiting for electric light. How much of the £19 million cut in the C.E.A.'s capital programme for 1956-57 would be borne by the London Electricity Board?

Mr. Jones said he could not give the detailed figures for the different Areas but, broadly, the cut would fall about equally on distribution and generation.

Mr Callaghan: In view of the serious nature of the cuts recently announced and the consequential serious effect upon other industries, would the Minister make a full statement, showing where the cuts are going to fall in the development of electricity, gas and coal production?

Mr. Jones asked for a separate question to be put down on this subject.

In answer to Mr. Vane, Mr. Jones said that the number of farm connections in England and Wales in 1956-57 should not be far short of 12,000. This was the annual average required for the completion of the present five-year programme and compared with 12,500 in the original plan for 1956-57.

Mr. Vane said that people living in the country who were waiting for electricity would be extremely pleased to hear this.

Mr. Palmer recalled that the Minister's predecessor had informed the House that the Government was making special provision for rural electrification. Was the House to understand that the Government still stood by that undertaking or was this a retreat?

Mr. Jones said Mr Palmer would be continuing the misapprehension if he suggested that there was, in any way, a retreat. "My predecessor initiated a five-year programme under which 60,000 farms were to be connected by the end of 1958. That programme still stands and there is no reason why it should be affected by the cuts now made in the programme for 1956-57," he added.

Mr. Nabarro asked the Minister Power whether he was aware that, notwithstanding his refusal to grant new finance to the electricity industry for hire-purchase contract facilities during 1956, hire-purchase sales of television sets, vacuum cleaners, radios, and similar equipment were proceeding; that such sales were being financed at the expense of power station construction, rural electrification, and other similar essential work; and as this was being financed out of working capital, whether he would withdraw this capital to repay outstanding capital borrowing by the Authority under Treasury guarantee.

Mr. Jones agreed that, especially in present circumstances, available capital should be used to the best advantage, and said he would not overlook Mr. Nabarro's point when he considered how the industry's reduced programme was to be financed.

Fixed Charges and Rateable Value

In reply to Mr. Page, Mr. Jones said that the North Western Electricity Board was the only Area Board intending to retain any tariffs based upon rateable value. The Board had announced that no alteration would be made in its tariffs as a result of the new rateable values.

OVERSEAS ELECTRICAL TRADE

Further Rise in Electrical Exports in January

THE electrical export figures for January indicate that the year has started well, the total value of £18.9 million being £1.8 million more than the December figure of £17.1 million, and £1.9 million better than the total for January, 1955, of £17 million. The various classes of equipment are listed in Table I. To the month's total must be added the following items which are listed elsewhere in the Board of Trade returns:—Washing machines, not exceeding 150 lb net weight, £273,952 (£256,793 in January, 1955), ditto, over 150 lb, but not exceeding £250 lb, £95,790 (£143,023), ditto, parts, £46,564 (£56,963); welding electrodes (excluding carbon), ferrous £103,294 (£99,883); ditto, non-ferrous £24,710 (£24,091); electric locomotives, £229,428 (£218,564); i.c. engine locomotives with electrical transmission, £678,806 (£422,985); electric light fittings and lanterns, complete, with or without lamps, £141,734 (£106,723), and other electric lighting appliances, £329,157 (£348,241). New classifications include diesel-driven generating sets driven by hydraulic turbines, arc lamps and searchlights complete, and time-recorders and time switches. House service meters (both prepayment and not prepayment) are now given under the heading "house service meters, including parts." The destinations of electrical equipment are given in Table II.

The best market for generating sets, generators and motors was India with a total of £514,455, and it is

TABLE I.—ELECTRICAL EXPORTS

Class	January 1955	January 1956
	£	£
Generating sets and generators:		
Diesel-driven, up to 10 kW	130,604	114,715
Ditto, 10 to 65 kW	105,447	118,210
Ditto, 65 to 200 kW	60,055	150,046
Ditto, over 200 kW	706,237	448,932
Spark ignition engine driven	12,579	70,897
Steam turbine driven	113,639	15,049
Hydraulic turbine driven		51,786
Other prime mover driven	10,616	69,371
Generators, not exceeding 200 kW	162,165	189,806
Ditto, over 200 kW	215,312	97,356
Parts of generators	757,002	922,391
Motors, complete, other than railway, tramway and trolley-bus:		
Up to ½ h.p.	243,915	186,974
Over ½ but under 1 h.p.	77,843	75,771
1 h.p. to 250 h.p.	492,754	461,425
Over 250 h.p.	212,289	83,609
Railway, tramway and trolley-bus motors complete and parts of all motors	153,040	207,675
Motor starting and controlling gear	209,953	223,172
	3,663,450	3,487,185
Converting machinery	46,796	31,428
Mercury-arc rectifiers	51,799	55,928
Transformers for lighting, heating and power (incl. coils)	1,001,663	1,150,190
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	373,658	199,593
Ditto, other	1,106,710	1,377,328
	2,580,626	2,814,467
Primary batteries:		
Lighting	67,014	84,627
Radio	122,332	223,290
Other	51,948	51,770
Parts (excl. carbons)	41,663	46,717
Lamps:		
Filament, exceeding 24 V	77,470	95,602
Ditto, under 24 V	29,644	30,984
Discharge lamps, fluorescent tubes, etc.	83,607	79,581
Arc lamps and searchlights	14,785	20,888
Radio and television, etc., apparatus:		
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilizing and cold cathode valves, magnetrons, klystrons*	39,564	32,632
Cathode-ray tubes	8,961	9,153
Other valves (not X-ray)*	181,175	218,011
Parts (excluding glass bulbs)		10,677
Radio and television transmitters	102,518	68,693
Commercial radio and radar equipment	837,510	1,014,325
Domestic radio receivers, mains	189,467	158,153
Ditto, battery	71,041	92,849
Ditto, other (incl. car)	13,695	32,141
Radiograms	43,939	44,455
Television sets	9,453	76,630
Public address equipment	84,456	82,950
Sound reproducing app., n.e.s.	23,224	39,760
Components and parts, n.e.s.	550,833	663,579
	2,181,723	2,544,008
Telegraph and telephone installations	1,005,407	840,090
Telephone instruments, separately consigned	61,504	104,301
Telegraph and telephone parts	423,218	570,980
Line apparatus for long distance commun.	113,991	90,771
	1,604,120	1,606,142

Class	January 1955	January 1956
	£	£
Cookers	162,907	90,875
Toasters	17,942	12,852
Other cooking apparatus	31,575	39,657
Parts and accessories	64,330	72,646
Space heating appliances	35,921	61,165
Water heating appliances	30,321	27,771
Other heating appliances	24,189	27,696
Parts and accessories	60,810	65,634
Irons	121,734	121,060
Arc welding equipment, a.c.	42,042	47,067
Ditto, d.c.	22,318	45,828
Resistance welding equipment	27,061	12,104
Electric furnace plant*	22,598	64,330
Magnetos, ignition	14,603	38,551
Sparking plugs	142,224	159,977
Elec. appliances for aeroplanes, n.e.s.	170,334	194,366
Ditto, for motor vehicles, n.e.s.	295,658	325,334
Ditto, for cycles, n.e.s.	65,078	83,425
Signalling app. (incl. traffic signals)	44,634	48,049
Industrial radio-frequency equipment	17,481	7,652
Bell app. (not telegraphic or telephonic)	6,417	8,543
Instruments, commercial	156,367	172,425
House service meters, including parts	143,942	171,044
Electro-medical apparatus (not X-ray)	50,432	83,830
X-ray apparatus (excl. tubes and valves)	73,200	63,036
Vacuum tubes	27,047	19,762
Desk fans, complete, and parts of desk and ceiling fans*	24,684	22,032
Ceiling fans*	100,078	71,445
Vacuum cleaners	121,243	100,584
Floor polishers	109,222	96,906
Food mixers	34,308	49,075
Hair clippers and dry shavers	70,940	42,781
Other portable appliances	58,691	29,993
Parts	74,580	82,957
Portable elec. tools (not saws) and parts	180,409	174,664
Cables and wires:		
Telegraph and telephone, submarine	93,505	78,282
Ditto, other	456,534	542,741
Cotton, silk or art. silk insulated	46,836	41,008
Enamel, glass or asbestos insulated	90,558	81,205
Paper insulated	707,298	1,456,903
Rubber insulated	509,541	566,351
Thermoplastic insulated*	64,705	116,433
Other	217,380	304,021
	2,186,357	3,186,944
Accumulators for motor vehicles	141,387	211,009
Ditto, traction	16,366	10,477
Ditto, radio and other portable	84,273	71,299
Ditto, other	12,997	67,267
Parts and accessories	122,820	105,707
Elec. porcelain, etc. (incl. insulators)	94,300	84,856
Insulating cloth and tape	72,672	74,514
Other insulating material	71,346	93,974
Permanent magnets	55,100	38,272
Radio, telegraph and telephone testing equipment, n.e.s.	22,551	32,346
Scientific elec. instruments (not telegraphic or telephonic)		
Time recorders and time switches, complete	18,895	10,312
Other	219,224	197,238
Electrical machinery, n.e.s.	85,692	124,667
Electrical apparatus and appliances, n.e.s.	639,909	794,309
TOTAL	17,007,591	18,923,568

* The 1955 and 1956 figures are not completely comparable.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

	January 1955	January 1956		January 1955	January 1956
	£	£		£	£
Channel Islands	64,774	96,073	Western Germany	112,066	180,756
Gibraltar	8,110	16,584	Netherlands	531,203	531,771
Malta and Gozo	104,733	82,994	Belgium	270,899	270,358
Cyprus	104,716	71,152	France	209,430	264,509
Sierra Leone	19,694	22,033	Switzerland	68,703	91,051
Gold Coast	114,136	142,436	Portugal	302,603	187,705
Nigeria	230,666	401,802	Spain	171,265	225,297
Union of South Africa	1,731,766	1,535,970	Italy	188,657	294,282
Rhodesia and Nyasaland	406,495	689,789	Austria	49,331	19,409
Tanganyika	68,116	93,414	Yugoslavia	108,692	42,590
Kenya	147,542	287,243	Greece	109,463	97,532
Uganda	60,462	59,698	Turkey	116,645	26,314
Anglo-Egyptian Sudan	180,579	70,879	Belgian Congo	55,186	41,487
Mauritius	20,058	18,311	French Morocco	20,791	44,500
Aden	50,230	53,655	Portuguese East Africa	15,863	21,617
Bahrain, Qatar and Trucial States	62,647	104,925	Egypt	83,753	183,909
Kuwait	63,566	109,491	Libya	18,954	15,026
India	1,283,766	2,017,780	Syria	20,610	46,963
Pakistan	328,589	415,925	Lebanon	28,683	43,113
Singapore	450,550	309,361	Israel	11,444	92,075
Federation of Malaya	248,382	232,704	Jordan	21,097	90,811
Ceylon	139,136	142,089	Saudi Arabia	97,112	39,926
British North Borneo	34,201	75,105	Iraq	202,784	305,469
Sarawak	34,760	26,199	Iran	43,999	190,950
Hong Kong	181,930	174,431	Burma	169,620	206,012
Australia	1,675,957	1,745,197	Thailand	408,092	128,412
New Zealand	1,770,055	764,002	Indonesia	14,298	67,827
Fiji	27,367	15,463	Japan	38,506	37,217
Canada	527,609	749,084	United States of America	180,180	1,010,059
Jamaica	86,006	122,577	Cuba	36,486	29,020
Barbados	24,318	37,716	Mexico	25,347	72,090
Trinidad	104,123	129,019	Colombia	109,415	168,481
British Guiana	34,865	46,514	Venezuela	325,422	613,698
Other Commonwealth countries	96,367	65,697	Peru	59,204	45,226
Irish Republic	299,539	308,705	Chile	148,299	39,636
Soviet Union	223,241	495,830	Brazil	92,131	261,564
Finland	116,042	134,028	Uruguay	43,270	11,253
Sweden	406,898	293,991	Argentine Republic	172,707	51,184
Norway	301,994	176,248	Other foreign countries	275,395	293,334
Iceland	17,513	29,513			
Denmark	162,659	130,258			
Poland	35,829	47,250	Total	17,007,591	18,923,568

interesting to note that second place is held by the United States with a total value of £373,790; the third most important market was Australia (£319,826). For converting machinery, mercury arc rectifiers, transformers and switchgear, the principal buyers were South Africa (£531,863), India (£402,918) and Australia (£275,596). The first three places for valves were held by India (£178,229), the Netherlands (£163,086) and South Africa (£144,966). Australia (£359,313), was the leading purchaser of telegraph and telephone equipment, followed by Brazil (£244,783). Venezuela (£502,421) was the largest buyer of electric wires, cables, etc., India (£497,250), Rhodesia and Nyasaland (£190,655) and New Zealand (£190,391) being other important purchasers.

The total value of imports of electrical machinery, apparatus and appliances was £1,873,329 (£1,491,696 in January, 1955), the chief suppliers being the United States (£474,589), the Netherlands (£375,643) and Western Germany (£335,421). The principal classes were radio, telegraph, telephone, etc., apparatus, £586,119.

Association of Consulting Engineers

THE Association of Consulting Engineers held their annual dinner at the Dorchester Hotel, Park Lane, on 20th February with Mr. J. S. Tritton in the chair.

The toast of the Association was proposed by the Earl of Home, Secretary of State for Commonwealth Relations. He spoke of the increased industrialisation in the great primary producing areas of the world, and said this would lead to far more work for British consulting engineers whose example throughout the world meant a great deal to British manufacturing firms. It was a great help when the consulting engineer could work in close touch with a contractor in a combined effort and he wondered whether we could learn from American practice in this respect. Consortiums of finance houses and manufacturers were growing and it might be that consulting engineers could join with these.

In the field of large overseas contracts the Russians as well as the Germans and Japanese were now becoming our rivals. There was no doubt about the quality of Russian work. It was, by all accounts, excellent and the Russian workers seemed to have a dedicated zeal which he hoped our own people had not altogether lost.

The chairman of the Association, Mr. J. S. Tritton, referred to the demands constantly being made to consulting engineers to boost exports but said it was difficult for them to do so because of their code of etiquette. They had recently altered their bye-laws so that in handling work in any overseas country they could conform with the professional practice in that country although that might not be the practice in this country.

He said that the World Bank, which was nowadays financing so many large projects, was increasingly becoming " consulting engineer minded " and now demanded project reports and supervision of the works by the International Federation of Consulting Engineers. He recently visited Canada and felt there was plenty of work in Canada for British consulting engineers, but personal visits had to be made.

The toast of the guests was proposed by Mr. John T. Calvert and replied to by the Rt. Hon. A. R. W. Low, Minister of State at the Board of Trade, who referred especially to the Middle East where the reputation of British consulting engineers counted for a great deal and could play a large part in preserving British prestige and expanding our trade.

INDUSTRIAL NEWS

Hire Purchase Restrictions

The changes in hire purchase and hiring regulations announced by the Chancellor of the Exchequer are set out in the Control of Hiring Order (S.I. 1956, No. 179) and the Hire Purchase and Credit Sale Agreements (Control) Order (S.I. 1956, No. 180). The Orders, which came into force on 18th February, provide for an increase from 15 to 20 per cent in the minimum deposit for a range of goods including cookers, water heaters, wash boilers and clocks, and from 33⅓ to 50 per cent for goods including radio and television sets, washing machines, vacuum cleaners and refrigerators. Control is extended to new classes of equipment covering commercial vehicles and plant and machinery of all kinds, for which the minimum deposit will be 50 per cent with the balance payable within 24 months. The control does not apply to exports.

Under credit sale agreements for less than nine months, for which no deposit is required, instalments must be approximately equal and at equal intervals.

For a hiring agreement of up to nine months, the whole of the rental and service charges must be paid before the agreement is signed. In any other agreement all charges payable during the first nine months must be paid in advance. Where goods have been hired for a definite period of nine months or less, the Order prohibits any further hiring to the person concerned, except that hirings for less than a month may be extended up to a month.

Improved Computer

It is now four years since the "Univac" computer produced by Remington Rand, Inc. of America was put into service. This company has now announced the production of an improved type known as the "Univac II" and incorporating as its principal development magnetic core storage. This, together with increased external storage capacity, nearly doubles the speed of processing and at the same time drastically cuts operating, servicing and information storage costs.

In the "Univac I" a single 35in long mercury tank held 16,380 pulses of information when used to the fullest capacity. In the new computer the magnetic core "memory," is much more compact; in seven small core matrices filling a space only 8in by 8in by 3½in it can contain 17,500 information pulses.

To keep up with a greater internal processing speed an improved external storage system has been included. The density of information recorded on "Univac" tape was formerly 128 characters to the inch. This has now been increased to 200 characters to the inch making it possible to store nearly 3,000,000 alphabetical or numerical characters on a single 8in reel of tape.

Large Distilling Plant Contract

A contract, worth about £1,250,000, for one of the largest sea-water evaporating and distilling plants in the world, to be installed at Aruba, Netherlands Antilles, has been obtained by G. & J. Weir, Ltd., in the face of intense international competition from fifteen other firms in Britain, America, Germany, Italy and France. The order was placed through Singmaster & Breyer, consulting engineers, New York. The plant, when completed in 1958, will provide 1,792,000 gallons of fresh water a day.

Aruba island, in the Caribbean, is an area where there is practically no rainfall, and the inhabitants are entirely dependent on fresh water distilled from the sea for all their needs. During the past thirty years Weir's have installed a number of smaller plants in this island, each with an output of 300 tons a day, but increasing local demands now call for a much greater supply. The new plant will comprise four sextuple-effect horizontal evaporating units, each with its own inter-stage pre-heaters, distilling condenser and pumps, and each unit will have a daily output of 2,000 tons of fresh water. A fifth similar unit may be ordered within the next six months.

Steam, bled from the turbines of the electrical power generating station, will be supplied to the heating coils of the first stage of each evaporator unit at a pressure of 30 lb/sq in and special provision is being made to prevent scale formation on the coils and inside surface of the evaporators. This will allow the plant to maintain the full rate of heat transfer, saving fuel and avoiding closing down the units for scale removal.

Among recent large orders received by this company for sea-water distilling plant are two for the Lobitos oil fields in Peru, to supply 270 and 500 tons of fresh water daily. The first of these has just been despatched to Liverpool for shipment. Another installation has just been completed at Kuwait, in the Persian Gulf, and is producing a million gallons a day.

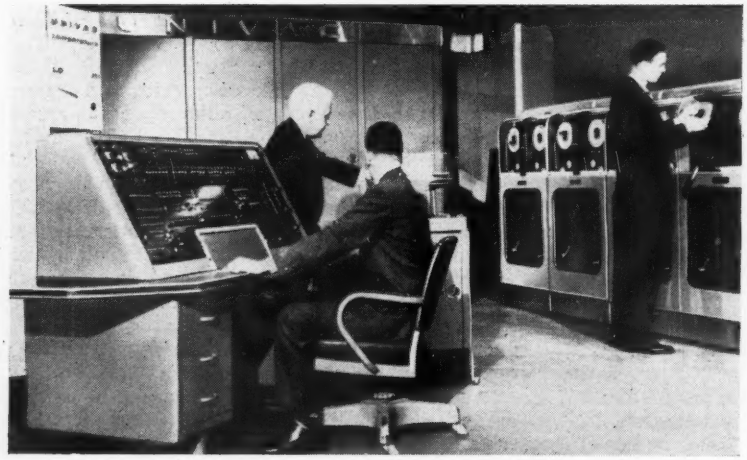
Advice on Welding

A new Sales Technical Service Department of British Oxygen Gases, Ltd., at Staples Corner, North Circular Road, Cricklewood, London, N.W.2, was opened on 20th February by Sir Frederick Handley Page. This department of the company was originally established in 1935 to give technical service to every industry using welding processes. With it is associated a welding school where each year 750 students are trained for customers.

The new buildings comprise an office block with a lecture theatre and photographic section; and a separate building containing a welding school and demonstration, cutting and process development shops. In the last-named shop work is being done on the welding of newer materials such at titanium and zirconium.

Tanker Electrical Equipment

Another 18,000 ton tanker, the *San Fabian* has been completed by Smith's Dock Co., Ltd., for the Eagle Oil & Shipping Co., Ltd. She is the third ship to be built under the Eagle Oil Co.'s programme, and all of these vessels have been supplied with the



Remington Rand "Univac" computer in use

major part of their electrical equipment by the General Electric Co., Ltd. Electric power in this new vessel is supplied by two G.E.C. 550 kW, 440 V, three-phase, 60 c/s turbo-alternators. For emergency and port use the ship is equipped with a 200 kW, 600 r.p.m. alternator driven by a Mirrlees diesel engine. The alternators are drip-proof and self ventilated, each having a terminal box on its upper half conveniently disposed for overhead cable connections to the main switchboard. The G.E.C. has supplied also the main, port and starboard group starter switchboards. All switchgear has a breaking capacity in excess of 12 MVA. The port and starboard group starters cover all engine-room auxiliaries of 5 h.p. and above. Among the 48 motors of various types with which the ship is equipped are three 56 h.p. main circulating pump motors, two 31 h.p. auxiliary circulating pump motors, two 17 h.p. forced lubricating oil motors, and air compressor, winch, service pump, and fire and bilge pump motors. The complete galley equipment supplied by the G.E.C. includes a two-oven range, a single deck baking oven, a proving cupboard, a steaming oven, a griller and a water boiler.

Fuel Efficiency Exhibition

A Fuel Efficiency in Industry Exhibition will be held at Olympia, London, from 2nd to 10th October next. It will have as its theme "Clean the Air." The latest plant and equipment, designed to reduce fuel bills and "smog," will be shown. The exhibition will be under the auspices of the National Industrial Fuel Efficiency Service and the Combustion Engineering Association, and will be organised by Provincial Exhibitions, Ltd. This exhibition has been staged in recent years in Manchester, but has proved of such wide interest that it is being moved to London in order to provide increased space and facilities. The introduction of the "Clean Air" Bill will compel all fuel users to install suitable plant to comply with its far-reaching regulations. This exhibition will show equipment to meet the new requirements. Over 100 leading concerns have already taken space.

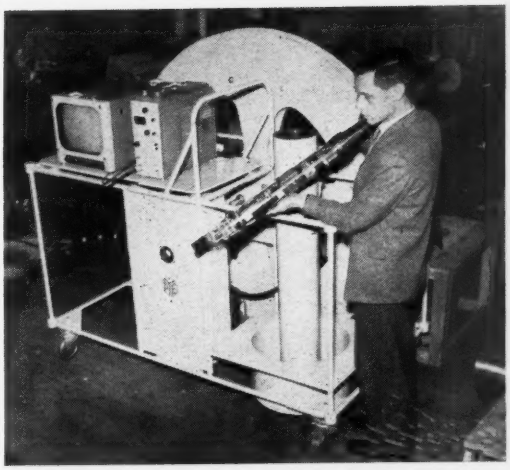
Television Inside a Reactor

After demonstrating industrial television to the Atomic Energy Authority last year, Pye, Ltd., of Cambridge were given a contract to design a special camera capable of being used inside an atomic reactor at the Authority's Cumberland factory. This has now been completed and has been delivered to Harwell for tests prior to its use at Calder Hall.

The camera, which is based on the normal industrial television equipment, has had to conform to certain very rigid specifications, and as a result of the experiments which were carried out at the Authority's premises it was found that special materials had to be used.

For ease of manipulation, the camera carries its own source of illumination consisting of a series of four small but powerful bulbs grouped around the camera's lens. In addition, a remotely controlled rotatable mirror enables all-round viewing to be obtained.

As the equipment is to be used while the atomic pile is dangerous, the camera can be remotely controlled and is housed in a thin stainless steel casing 3½in in diameter and 30in long. The whole apparatus, involving the camera and its 75ft of cable, the control unit and the monitor, is mounted on a trolley so that it is ready for instant use. As the camera is liable to be exposed to temperatures of up to 200 deg C, the control cables leading to the camera head are enclosed in a flexible hose through which carbon dioxide is pumped to cool the cables and camera. Radioactive dust can be removed from the camera, after its withdrawal from the reactor, by washing down.



The camera assembly, with stainless steel case removed, and the remote control apparatus trolley

A second camera, which is now being made, is to be supplied to the Authority within the next six months and will be used as a standby.

P.O.A. Conference

The Purchasing Officers Association is holding a London Regional Conference at the Cannought Rooms, Great Queen Street, Kingsway, London, W.C.2, on 21st April (10.30 a.m. to 4.30 p.m.). In the morning, Sir Donald Perrott, K.B.E. (United Kingdom Atomic Energy Authority), will speak on "The Impact of Atomic Energy on British Industry." The lunch speaker will be Mr. W. J. Brown. In the afternoon, Sir Oscar Hobson, M.A. (city editor, *News Chronicle*), will speak on "Budget Pointers for Business." The Conference fee is £1 and applications should be made to the secretary of the Association, Wardrobe Court, 146A, Queen Victoria Street, London, E.C.4.

Institute of Metals

The Spring Meeting of the Institute of Metals will be held from 10th to 13th April. The first session will be held at the Royal Institution, Albemarle Street, London, W.1, when Dr. Willis Jackson will deliver the May Lecture on "Ferroelectrics—The Dielectric Analogue of Ferromagnetics." On the following day the annual general meeting will be held at Church House, Westminster, when Major C. J. P. Ball will be installed as the new president and will deliver his presidential address on "The History of Magnetism." In the afternoon there will be a discussion on "Materials for Nuclear Power Engineering." A dinner and dance will be held at Grosvenor House, Park Lane, W.1, in the evening.

On Thursday (12th April) there will be a symposium on "The Final Forming and Shaping of Wrought Non-Ferrous Metals", and discussions on "Powder Metallurgy" and "Rolling Textures and Recrystallisation." An informal conversazione and exhibition of materials employed in nuclear engineering will be held in the evening at 4, Grosvenor Gardens, S.W.1.

The final session (13th April) will be held at the Institution of Naval Architects, Upper Belgrave Street, S.W.1, when there will be a discussion on "Alloy Thermodynamics."

Floodlight Training for Athletes

On 16th February at the University of London Athletic Ground, Motspur Park, Surrey, the inauguration took place of winter training facilities under artificial lighting for athletes of international standard, and particularly for those who might be considered as prospective members of Britain's athletic team for the forthcoming Olympic Games. The Benjamin Electric, Ltd., supplied the lighting fittings to the British Amateur Athletic Board; these are "Duoflux" floodlights, each of which consists of two reflectors—the main reflector being made from heavy gauge steel and finished with "Crysteel" vitreous enamel.

Field events have received special consideration. For example the fitting for the high jump is positioned only 20 ft above ground level so as to concentrate the illumination on the jump and immediate surrounding area. At the opposite end of the track, three floodlights, each housing a 1,000 W lamp, are mounted at 30 ft concentrating on the long jump, pole jump, etc. This new winter training scheme is

under the supervision of Mr. Geoffrey Dyson, the A.A.A. chief coach. Mr. Jack Crump, hon. secretary to the British Amateur Athletic Board, and British team manager, in opening the meeting thanked the Benjamin Electric, Ltd., for providing the floodlighting. During the evening Miss Jean Scrivens, Mr. Gordon Pirie and other international athletes gave demonstrations.

Canadian Aircraft Equipment Order

An initial contract valued at $800,000 for the supply of search, rescue and homing equipment ("Sarah") made by Ultra Electric, Ltd., has been placed by the Royal Canadian Air Force. "Sarah" is already in full production for, and installed in, aircraft of operational squadrons of the Royal Air Force, and though its use by the R.C.A.F. will be primarily military it will also serve for civil rescue duty. The equipment for the R.C.A.F. will be supplied through Ultra Electric's associated distributors, Canadian Aviation Electronics, Ltd., of Ville St. Laurent, P.Q.

Switchgear for Atomic Energy Authority

The British Thomson-Houston Co., Ltd., has received an order valued at £230,000 for 3·3 kV 150 MVA air-break switchgear for the Capenhurst works of the United Kingdom Atomic Energy Authority. It is a repeat of an earlier order valued at £213,000 now nearing completion.

Stabilisation of Prices

A plea for price stabilisation in the nationalised industries was made in Birmingham on 16th February by Mr. J. P. Ford, chairman of the Institute of Export and managing director of Charles Colston, Ltd. Proposing the health of the City of Birmingham at the annual dinner of the Institute of Export's West Midlands Branch, Mr. Ford said that if manufacturers could contract forward at fixed prices for coal, power, steel and transport, innumerable firms could then stabilise their prices; this would help to halt the present inflationary spiral which was gradually tending to price British manufacturers out of the export markets of the world.

Production Exhibition

The Institution of Production Engineers held a Press conference recently to describe the production exhibition and conference which they will be holding from 23rd to 31st May this year.

The exhibition will be held in the Grand Hall at Olympia and will be divided into sections as follows: Research and development; information; training and education; aids to production; metals and materials; new methods of production; and automation and work study methods.

The theme of the conference is to be "Investing in Success" and speakers will deal with the varied aspects of industry implicit in the theme.

The exhibition is not a "trade fair" in the usual sense but is intended to show how individual companies have improved their output, by different methods, and to demonstrate the latest means available for accomplishing such improvements.

The works visit scheme is being extended. Under this scheme manufacturers from every type of industry will send parties to the exhibition. Details of this scheme and concession tickets may be obtained from the exhibition organisers, Andry Montgomery, Ltd., 32, Millbank, London, S.W.1 (telephone: Tate Gallery 8134/8).

Electrical Wholesalers' Federation

The annual general meeting of the Electrical Wholesalers' Federation will be held on 15th March at the Dorchester Hotel, London, and will be followed in the evening (6.30 for 7 p.m.), also at the Dorchester, by the annual dinner. The principal guest will be Mr. N. Collins, deputy chairman of Associated Television, Ltd., and chairman of Higher Definition Films, Ltd.

Simplex-Ampro Dealers' Conference

Over 100 Ampro dealers from all over the country attended a conference and dinner at the Waldorf Hotel, London, on 15th February. It was held primarily to introduce the new educational 16 mm projector. Mr. T. Chilton, managing director, Simplex-Ampro, Ltd., welcomed the dealers and Mr. G. B. G. Potter, director, Simplex-Ampro, and managing director of Kelvin & Hughes, Ltd. (manufacturers of Ampro equipment), in summing up the conference speeches, also referred to the I.T.A. which has recently purchased 25 Ampro Major Mk.III projectors.

Frigidaire Sales Convention

Nearly 1,000 distributors, household dealers, and members of the Frigidaire Division of General Motors organisation, from home and overseas, attended the Frigidaire 1956 sales convention at the Scala Theatre, London, on 2nd February, and the evening banquet at the Grosvenor House, Park Lane.

The convention opened with a musical introduction, including a specially composed Frigidaire song, by Ted Heath and his orchestra. Professional actors and actresses were cast in a two-act sales promotion fantasy entitled "We the People", in which Frigidaire products, both household and commercial, were presented for "John Bull" (characterising the British public) to determine which would do most to improve the standard of living in 1956. Talks on household and commercial sales promotion followed until the finale, when a fanfare from the trumpeters of the Royal Horse Guards brought the Scala sessions of the convention to a close. Talks during the convention were given by Messrs. A. W. Porter (director and general manager); G. E. Worssam (general sales manager); W. R. Seabrook, (household sales manager); T. E. Trotman, (household sales department); B. P. Evans, (commercial sales manager); R. S. Palmer (assistant commercial sales manager); K. H. Vere (sales promotion and advertising manager); and R. C. Davison (assistant sales promotion manager).

Electrostatic Loudspeaker

H. J. Leak & Co., Ltd., held a Press conference on 9th February to demonstrate their new electrostatic loudspeaker and celebrate their "coming of age". Mr. H. Leak explained that with the electrostatic loudspeaker the driving force on the vibrating element was applied evenly over the entire surface. This was no longer a cone but a very light plastic surface metallically coated so as to sustain an electrostatic charge. At present very low notes were not practicable with such speakers which were being used from about two octaves above middle C. Below that frequency an improved moving coil speaker was still used. He also introduced a new f.m. tuner unit.

E.A.W. Activities

New E.A.W. Branches have been formed at Llanelly and Tenby.

Calendar

The Parolle Electrical Plant Co., Ltd., has sent us a calendar (March, 1956, to February, 1957). Each of the two-monthly sheets has an excellent drawing of a famous coaching inn in the north-east.

Trade Announcements

Walter Logan & Co., Ltd., 34, Oak Tree Drive, Totteridge, London, N.20, have appointed Law & Plumtree, 6, Lansdowne Road, Erdington, Birmingham 24 (telephone: Erdington 0460) as their agents for "Baer" appliance switches for the whole of the Midlands.

Measuring Instruments (Pullin), Ltd., have appointed Mr. T. A. C. Moorhouse as northern area technical representative, covering Northumberland, Westmorland, Cumberland, Durham and the ridings of Yorkshire. He is based at Whitley Bay (telephone: Whitley Bay 21277).

Mr. L. Maynard, 306a, Fulham Road, London, S.W.10, has been appointed by **Nettle Accessories, Ltd.**, as their agent for the area covered by the Southern Electricity Board.

Mr. A. Starsmore, of Sheffield, has been appointed agent for **FitzGibbon & Murray, Ltd.**, for the counties of Derby, Nottingham, Lincoln and Leicester, in succession to the late Mr. A. Walkington.

NEW ELECTRICAL EQUIPMENT

80 mm 200 W Lamp

A new 200 W g.l.s. lamp having a diameter of 80 mm, the same as that of the 150 W lamp, has been introduced by PHILIPS ELECTRICAL CO., LTD., Century House, Shaftesbury Avenue, London, W.C.2. The light centre length of the new lamp is the same as that of the 90 mm type so that it can be used in optically designed fittings without affecting light distribution.

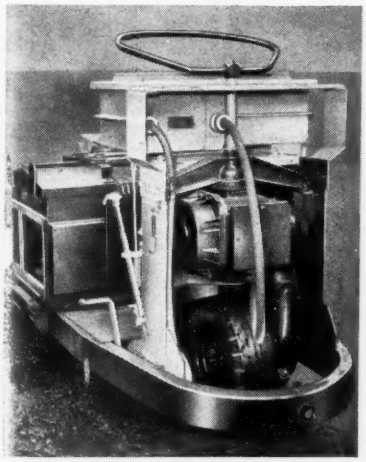
Cap temperature is no higher than that of the 90 mm, and e.s. caps are supplied as standard; b.c. caps are also available. Increased light intensities can be obtained by replacing the 150 W lamps with the 80 mm 200 W type, but it should not be used in totally enclosed fittings designed for a maximum lamp size of 150 W. Care should also be taken to see that the cut-off angles are retained.

The prices are as follows:—"Argenta," 4s 3d plus 10½d purchase tax in the United Kingdom; pearl and clear, 3s 9d plus 9½d purchase tax. The 90 mm 200 W lamps will continue to be available in the foregoing finishes.

Flameproof Truck

A flameproof battery electric truck for all commercial purposes has been designed and built by BRUSH COACHWORK, LTD., Loughborough, and a number of orders have already been received from industrial concerns in this country and abroad. The new development means that electric trucks are available for use in areas where explosive or inflammable materials are present, obvious examples being paint, chemical, and plastic plants, ammunition depots, oil refineries, and airfields.

Brush flameproof electric truck with front cover removed to show power unit



Based on the company's standard industrial truck, the flameproof vehicle has a payload of one ton and a turning radius of 6ft 3in. It differs, however, in certain important respects, the chief of which is that the flameproof truck has its control gear and motor totally enclosed to the standards laid down by B.S. 229 : 1946, Groups II and III. These Groups cover the use of equipment in the presence of blast-furnace gas, hydrocarbons met in the distillation of crude oil and the use of petroleum, liquids derived from coal tar, solvents used in industrial processes, and coal and coke-oven gas.

Clip-on Wattmeter

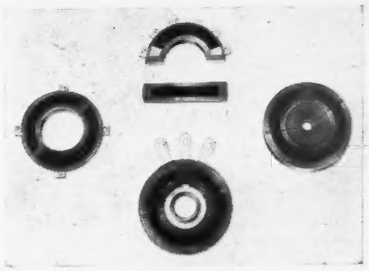
The type "W" seven-range clip-on wattmeter announced by FERRANTI, LTD., Hollinwood, is an entirely new instrument for the measurement of electrical power in a.c. circuits. It is easy and convenient to use: voltage connections are made by a pair of spring clips and the current coil is operated by a core which is opened by a trigger and closed around the conductor. The movement is of the iron-cored dynamometer type and the ranges covered, from 0-3 to 0-300 kW at voltages up to 600, are all self-contained and conveniently selected by means of a thumb-operated switch.

Ferranti clip-on wattmeter for use up to 300 kW

A high margin of safety is assured by substantial insulation throughout the instrument and a h.r.c. fuse is incorporated in each of the voltage clips.

Resistive Elements

New types of precision resistive elements which achieve high standards of accuracy and reliability have recently been introduced by the PLESSEY CO., LTD., Ilford, Essex. The resistive material in each element is an integral part of the body which is manufactured from a special high-grade low-loss phenolic moulding material. This method of construction ensures high stability and the component is resistant to extreme humidity and temperature. The elements can be incorporated in standard or special assemblies according to the user's application, types being available for either linear or angular control movement. A high standard of performance has been achieved under extremes of temperature from −40 deg C to +100 deg C. Assembled as variable resistors the elements have been subjected to many millions of operations of the contact wiper with negligible deterioration.

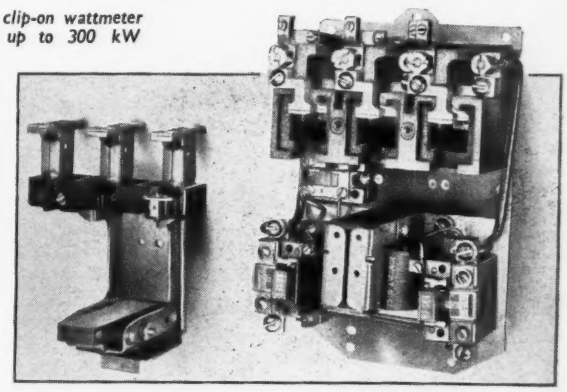


Selection of Plessey resistive elements

Control Gear

Following the formation of SQUARE D, LTD., 100, Aldersgate Street, London, E.C.1, a British subsidiary of a leading American manufacturer of electrical control gear and switchgear, it is announced that the company has now commenced operations in this country. The first products to become available include a range of a.c. magnetic starters which provide a simple and economical method of starting, stopping and protecting a.c. squirrel cage motors.

Square D starter with contactor unit detached



Initially, the starters will be available in four sizes, covering motor horse-power ratings up to 50 h.p. at 400-440 V. Most of the components, including the contacts, may be removed with a screwdriver without disturbing the wiring. Design features include vertical action with a guided armature and silver to silver double break contacts which do not need cleaning.

GENERATION AND DEVELOPMENT

Electricity Boards' Sales

The accompanying table analyses the sales of the twelve Electricity Boards in England and Wales in January. The national figures show an increase over January, 1955, of 7·2 per cent, but when corrected for weather conditions and working days (28·41 against 28·19 in January, 1955) the increase is 8·4 per cent.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for January (million kWh)			Twelve Months Totals Ended 31st January		
	1955	1956	Inc. or Dec. %	1955	1956	Inc. or dec. %
London	731.0	767.7	+ 5.0	6,133.3	6,598.8	+ 7.6
South Eastern	424.6	452.2	+ 6.5	3,679.7	4,041.1	+ 9.8
Southern	501.2	544.7	+ 8.7	4,394.6	4,872.9	+10.9
South Western	247.7	267.9	+ 8.2	2,263.3	2,504.2	+10.6
Eastern	682.6	732.5	+ 7.3	6,012.4	6,565.1	+ 9.2
East Midlands*	561.4	599.7	+ 6.8	5,146.1	5,649.1	+ 9.8
Midlands*	752.6	790.0	+ 5.0	6,898.0	7,435.5	+ 7.8
South Wales*	381.8	415.4	+ 8.8	3,980.4	4,330.0	+ 8.8
Merseyside and N. Wales*	420.9	451.8	+ 7.3	3,972.4	4,446.2	+11.9
Yorkshire*	708.0	771.0	+ 8.9	6,708.2	7,351.0	+ 9.6
North Eastern*	400.3	428.5	+ 7.0	3,967.8	4,254.0	+ 7.2
North Western*	762.0	809.3	+ 6.2	7,446.9	7,872.6	+ 5.7
Total all Area Boards	6,574.1	7,030.7	+ 6.9	60,603.1	65,920.5	+ 8.8
Direct Supplies by Central Authority	146.3	172.8	+18.1	1,334.9	1,754.9	+31.5
Grand Total	6,720.4	7,203.5	+ 7.2	61,938.0	67,675.4	+ 9.3
Mainly Industrial Areas*	3,987 0	4,265.7	+ 7.0	38,119.8	41,338.4	+ 8.4
Mainly Non-Industrial Areas	2,587.1	2,765.0	+ 6.9	22,483.3	24,582.1	+ 9.3

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

Nuclear Research in Holland

The Dutch concern, N.V. tot Keuring van Elektrotechnische Materialen of Arnhem (KEMA), has submitted a request to the Town Council for permission to build a nuclear-physical laboratory at Arnhem. The head of the proposed new laboratory will be a Netherlands scientist who has designed a reactor which is now under construction at the KEMA works.

First Polish Turbines

Following prototype tests and trial runs, the first set of entirely Polish-made turbines was put into operation recently at the power station of the Andrychow Cotton Mills. The design was worked out by a team of engineers from the Gdansk Institute of Rotor Machines of the Polish Academy of Sciences, the plant being produced at the Elblag Engineering Works.

Argentine Power Shortage

The *Fortnightly Review* of the Bank of London & South America, Ltd., quotes the Argentine Ministry of Industry on the subject of the present shortage of electric power. All plant was said to be operating at full capacity and machinery could not be taken out for overhaul without serious inconvenience to the public. Interruptions in supply were occurring in various parts of the capital and the surrounding district and it was thought unlikely that this situation could be corrected for at least eighteen months. Shortages of power would inevitably occur next winter when conditions would deteriorate appreciably.

After four years' delay the contract for linking the San Nicolas power plant with Greater Buenos Aires was signed in December but the lines would not be finished before the winter of 1957. "From now until then the supply of current will be in a state of permanent crisis."

Rural Electrification in Uganda

As a further step in the electrification of rural Uganda, Mr. Wanambwa, the Secretary-General of the Bugisu African Local Government Council, switched on an electricity supply to Siroko, in East Uganda, on 11th February. The ceremony was watched by over 150 people, including Mr. W. D. D. Fenton, chairman of the Uganda Electricity Board, Mr. J. B. Lubandi, a member of the Board, and the Hon. Y. B. Mungoma, a member of the Legislative Council. The extension was made possible because of the supply of electricity which had been given a few weeks earlier to the Siroko ginnery.

Mr. Wanambwa, in reply to Mr. Fenton, expressed the thanks of the people of Bugisu for the introduction of electricity to the district. The chairman of the Board had mentioned that Siroko was the furthest point of supply from the hydro-electric station at Owen Falls, Jinja, and Mr. Wanambwa said he hoped the line would be extended even further in order that more people could enjoy the benefits of electricity.

In his speech, Mr. Fenton referred to the desire of the Board to press on as rapidly as possible with the distribution of electricity throughout Uganda and welcomed the opportunity of going to Siroko to explain the Board's policy of supplying rural areas with electricity. Uganda, he said, was fortunate in having valuable hydro-electric resources. Electricity in rural areas could be exceptionally useful in improving standards of living and increasing productivity on farms.

Mr. W. D. D. Fenton, chairman of the Uganda Electricity Board, speaking at the switching on of the supply to Siroko

Financing Kariba Project

The Minister of Finance of the Federation of Rhodesia and Nyasaland announced in the Federal Assembly last week that the Northern Rhodesian copper mines were to contribute £30 million for the Kariba hydro-electric project, the British South Africa Company £4 million, Barclays Bank £2 million and the Standard Bank of South Africa £2 million. Of the £30 million from the Copperbelt mines £20 million would be in the form of a special Government loan at 4½ per cent. In addition, the companies concerned were prepared to accept a surcharge on Kariba power over the period 1961-67 which would yield £10 million. If overseas sources of finance were mobilised to the degree expected, a substantial margin would be available for other projects.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 5th March

BIRMINGHAM.—James Watt Institute, 6 p.m. I.E.E. South Midland Centre. "Electrical and Magnetic Measurements in an Electrical Engineering Factory," by D. Edmundson.

IPSWICH.—Crown and Anchor Hotel, 6.30 p.m. I.E.E. East Anglian Sub-Centre. "The Supply of Electricity in the London Area," by D. B. Irving.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "Problems of Hyro-Electric Design in Mixed Thermal and Hydro-Electric Systems," by T. G. N. Haldane and P. L. Blackstone.

LONDON.—Savoy Place, W.C.2., 5.30 p.m. Institution of Electrical Engineers, informal meeting. Discussion on "Is the Electrical Equipment of the Modern Motor Vehicle Sufficiently Reliable?" opened by Dr. E. A. Watson.

Caxton Hall, S.W.1., 7 p.m. E.P.E.A. London Technical Group. "Pulverised Fuel Firing and Large Furnaces," by C. W. Pratt and A. H. Kirkby.

Burlington House, W., 5.30 p.m. Society of Engineers. "The Present Trends in Hydro-Electric Development," by A. A. Fulton.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurement Group. "Maintenance Principles for Automatic Telephone Exchange Plant," by R. W. Palmer.

County Hotel, Neville Street, 6 for 6.30 p.m. North East Electrical Club. "The Electrical and Mechanical Equipment of the Mersey Tunnel," by C. C. Smith.

Tuesday, 6th March

ARBORFIELD.—R.E.M.E. Training Centre, Bailleul Barracks, 7 p.m. I.E.E. London Graduates' & Students' Section, district meeting. "Mechanical Vibrations and the Electrical Engineer," by D. E. Mullinger.

DERBY.—E.M.E.B. Service Centre, 6.30 p.m. I.E.E. East Midland Centre. "Fault Location in the Supply Industry," by T. David.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "Nuclear Reactors and Power Production," by F. M. Greenlees.

HAMMERSMITH. — Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Any Questions?"

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Graduates' & Students' Section. "Attitudes of Mind," by A. R. Cooper.

LONDON.—Criterion, W.1, 7 for 7.30 p.m. I.E.E. Supply Section. Dinner-dance.

At the Institution of Electrical Engineers, Savoy Place, W.C.2., 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "Review of Basic Factors in Local Line Planning," by R. MacWhirter and H. J. S. Mason.

At the Royal Society of Arts, John Adam Street, W.C.2., 7 p.m. Incorporated Plant Engineers, London Branch. Annual meeting.

LUTON.—Midland Hotel, Williamson Street, 8 p.m. A.S.E.E. Luton Branch. Lecturettes.

MANCHESTER. — Engineers' Club, Albert Square, 7 p.m. I.E.E. North-Western Centre. "The Wind and the Rain," by Prof. Crowe.

Electricity Demonstration Theatre, Town Hall, 7 p.m. Women's Engineering Society, Manchester Branch. "Space Heating," by E. S. Hancock.

READING. — University Lecture Theatre, London Road, 7 p.m. A.S.E.E. Oxford, Reading & Districts Branch. "Industrial Electronic Control," by C. J. Teece.

Tuesday, 6th March to Thursday, 8th March

LONDON. — Royal Hotel, Woburn Place, Television Society. Annual exhibition.

Tuesday, 6th March to Saturday, 31st March

LONDON.—Olympia. Ideal Home Exhibition.

Wednesday, 7th March

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. Scottish Centre chairman's address, by Dr. E. Wilkinson.

BARNSLEY.—Town Hall, 7 p.m. I.E.E. North Midland Centre. "Electrical Energy from the Wind," by E. W. Golding. (Joint meeting with the Sheffield Sub-Centre).

BIRMINGHAM.—James Watt Institute, Great Charles Street, 7 p.m. Junior Institution of Engineers, Midland Section. Re-delivery of presidential address, "Dams," by G. M. Binnie.

EDINBURGH. — Y.M.C.A. Hall, 14, St. Andrew's Street, 6.15 p.m. I.E.S. Edinburgh Centre. "Lighting and Production," by J. W. Howell.

HOVE.—S.E.E.B., 6.30 p.m. I.E.E. Southern Centre. "The Recent Search for and Salvage of the Comet Aircraft near Elba," by Cmdr. C. G. Forsberg, R.N., and G. G. MacNeice.

LEEDS.—Queens Hotel. Institution of Civil Engineers, Yorkshire Association. Annual dinner.

LEICESTER.—College of Art & Technology, 6.30 p.m. Incorporated Plant Engineers, Leicester Branch. "Industrial Radiography," by E. J. Grimwade.

LONDON.—Savoy Place, W.C.2., 5.30 p.m. I.E.E. Radio & Telecommunication Section. "Frequency-Modulation Radar for Use in the Mercantile Marine," by D. N. Keep.

I.E.E. London Graduates' & Students' Section. Visit to Broadcasting House, B.B.C., W.1., at 2.30 p.m.

At the Royal Society of Arts, John Adam Street, W.C.2., 6.45 p.m. Institution of Engineering Inspection, London Branch. "The Owen Falls Dam," by Sir Charles Westlake.

At the Institution of Civil Engineers, Great George Street, S.W.1., 5.30 p.m. Institute of Fuel. "The Maintenance of High Efficiencies on Economic Boilers: A Record of Operating Experience," by I. S. Groundwater.

MANCHESTER. — Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. "Plastics in the Electrical Industry."

MIDDLESBROUGH.—Cleveland Scientific & Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "Maintenance Principles for Automatic Telephone Exchange Plant," by R. W. Palmer.

NEWCASTLE-UPON-TYNE. — King's College, College Road, 6.15 p.m. I.E.S. Newcastle Centre. "A New Approach to Interior Lighting Design," by J. M. Waldram.

NORWICH.—Lido Ballroom, Aylsham Road, 7 for 7.30 p.m. Norfolk Electrical Social Committee. Dinner dance.

SWANSEA.—S. Wales Electricity Board's Demonstration Theatre, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. Film evening.

WIMBLEDON.—Guild House, 32, Worple Road, 8.15 p.m. A.S.E.E. South-West London Branch. "Ventilation Systems," by J. R. Kell.

Thursday, 8th March

CARDIFF.—S. Wales Electricity Board's Demonstration Theatre, The Hayes, 5.45 p.m. I.E.S. Cardiff Centre. Film evening.

At the South Wales Institute of Engineers, Park Place, 6 p.m. Association of Mining Electrical & Mechanical Engineers, South Wales Branch. "The Development of Atomic Energy," by C. Grey Morgan.

DUNDEE.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. Scottish Centre chairman's address, by Dr. E. Wilkinson.

EXETER.—Royal Clarence Hotel, 3 p.m. I.E.E. South-Western Sub-Centre. "The Electrification of the Manchester-Sheffield-Wath Lines, Eastern and London Midland Regions, British Railways," by J. A. Broughall and K. J. Cook.

LEICESTER.—Windsor Room, Bell Hotel, 7 p.m. Institution of Production Engineers, North Midlands Region, Leicester Section. "Computor Control of Machine Tools," by D. T. N. Williamson.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institution, Corporation Road, 7.30 p.m. Society of Instrument Technology, Tees-Side Section. Annual general meeting, followed by "Planned Maintenance," by P. Hutten.

SOUTHAMPTON. — Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. "Industrial Lighting," by S. E. Harris.

SWANSEA. — S. Wales Electricity Board Showrooms, The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Speed Control of A.C. Motors for Hoist Motions," by A. D. J. Ratcliffe.

Friday, 9th March

BRISTOL.—Hawthorns Hotel. I.E.S. Bath & Bristol Centre. Annual dinner-dance.

CREWE.—Royal Hotel, 8 p.m. A.S.E.E. Stoke & Crewe Branch. Technical discussion.

HUDDERSFIELD.—George Hotel, 7 for 7.30 p.m. Institution of Production Engineers, East & West Ridings Region, Halifax Section. Dinner-dance.

LEEDS.—Mansion Hotel. A.S.E.E. Leeds Branch. Annual supper-dance.

LONDON.—Caxton Hall, S.W.1., 6.30 p.m. E.P.E.A. Southern Meter Engineers' Group. "Brains Trust."

The Feathers Hotel, Broadway, S.W.1., 6 p.m. Electrical Trades' Commercial Travellers' Association. Talk on his trip to South Africa and Rhodesia by L. A. Fickling, with coloured slides.

21, Albemarle Street, W.1., 9 p.m. Royal Institution of Great Britain. "Radioactive Isotopes and their Applications," by P. I. Dee.

Hope House, 45, Great Peter Street, S.W.1., 7 p.m. Women's Engineering Society, London Branch. "The First World Conference on Industrial Accident Prevention, 1955," by Miss B. P. Park.

MANCHESTER.—Grand Hotel. Manchester Association of Engineers. Dinner and dance.

NEWCASTLE - UPON - TYNE. — Incorporated Plant Engineers, North East Branch. Annual dinner and dance.

NOTTINGHAM. — Victoria Station Hotel. I.E.S. Nottingham Centre. Ladies' evening.

PORTHCAWL.—Seabank Hotel, 7 for 7.30 p.m. I.E.E. Western Centre. Annual dinner-dance.

PORT SUNLIGHT.—Hulme Hall, 7 p.m. I.E.E. Mersey & North Wales Centre. Dinner-dance.

WEYMOUTH.—South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre, district meeting. "Transistor Power Amplifiers," by D. D. Jones.

Saturday, 10th March

EDINBURGH.—Incorporated Plant Engineers, Edinburgh Branch. Annual dinner.

OXFORD.—Y.M.C.A., 10, George Street, 6.30 p.m. A.S.E.E. Oxford, Reading & Districts Branch. "A.C. Variable Speed Control," by W. G. Wrigley.

Master Bakers and Lighting

The E.L.M.A. Lighting Service Bureau is holding a day illumination design course of lectures to be given to the Association of Master Bakers, from 26th to 28th March at 2, Savoy Hill, London, W.C.2. Those wishing to attend should notify the Bureau as soon as possible.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—20th March. Metropolitan Water Sewerage and Drainage Board, New South Wales. Two electrically driven centrifugal pumping units for the Menai pumping station. (E.S.B. 4284/56. Ten/18037.)* 28th March. State Electricity Commission of Victoria. Telemetering equipment. (E.S.B. 3866/56. Ten/17987.)* 3rd April. Department of Public Works, New South Wales. Electrically-driven pumping plant for Broken Hill water supply. (E.S.B. 4282/56. Ten/18038.)* 10th April. Commonwealth of Australia. Bells and buzzers. (E.S.B./4254/56. Ten/18036.)* 17th April. Director, Posts and Telegraphs, G.P.O., Melbourne. Switchboard keys. (E.S.B. 4253/56. Ten/18060.)*

Blackburn.—12th March. R.D.C. Five electrically-driven pumps. Arnold Brooksbank, consultant engineer, General Buildings, 48, Sunbridge Road, Bradford, Yorks.

Dublin.—9th March. Commissioners of Public Works. Electrical installation at Lifford National School, Co. Donegal. J. Tyrrell, secretary, Commissioners of Public Works, Dublin.

Formosa.—12th March. Central Trust of China, Purchasing Dept., Taipei. Power supply equipment, including switches, transformers, air compressors, fans, cable and relays. (E.S.B. 3489/56/ICA. Ten/17991.)*

Greece.—6th April. Ministry of Foreign Affairs. Underground power station at a naval base. (E.S.B. 4277/56. Ten/17196A.)*

India.—7th March. Madhya Pradesh Electricity Board, Nagpur. Steel towers, insulators, conductors, cable, etc., for the Korba-Bhila 132 kV transmission line. (E.S.B. 3786/56. Ten/17975.)* Government of Mysore. 200-750 kVA transformers for frequency conversion. (E.S.B. 3982/56. Ten/17996.)* 12th March. Two 1,000 kVA and eleven 100 kVA transformers, circuit breakers, cable, etc. (E.S.B. 3981/56. Ten/18003.)* 120 sets of street lighting fittings and spares. (E.S.B. 4342/56. Ten/18068.)* 5,000 V indoor type switchgear cubicles, cable, etc. (E.S.B. 3985/56. Ten/18053.)* 110 kV oil circuit breakers, switches and lightning arrestors. (E.S.B. 3983/56. Ten/17995.)* 15th March. Director General of Supplies and Disposals, New Delhi. Underground telephone cable. (E.S.B. 3924/56. Ten/18000.)*

New Zealand.—16th March. Auckland Electric Power Board. Triple braided v.i.r. cable. (E.S.B. 3377/56. Ten/17984.)* 11th April. General Post Office. Transmission equipment. (E.S.B. 4267/56. Ten/18035.)* 26th June. State Hydro-Electric Dept. Three 111 kVA generators for Ohakuri power station. (E.S.B. 4270/56. Ten/18051.)*

Peterborough.—29th March. Combined Police Authority. Heating and electrical installation at the proposed police headquarters, Bridge Street. (See this issue.)

Philippines.—14th March. National Power Corporation. Four completely co-ordinated load-end substations. (E.S.B. 4022/56. Ten/18019.)*

Portuguese East Africa.—30th April. Ports, Railways and Transport Dept., Lourenco Marques. Transformer station and h.v. underground cable. (E.S.B. 4024/56. Ten/18012.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1. (Chancery 4411; extension 769).

St. Neots.—12th March. U.D.C. Street lighting equipment. (See this issue.)

South Africa.—14th March. Stores Department, South African Railways. 3,050 thermal starting switches for 20-30 W fluorescent lamps for train lighting. (E.S.B. 4354/56. Ten/18058.)* 16th March. 3,000 dry cells and 3,000 accumulators. (E.S.B. 4361/56. Ten/18065.)* City of Durban Corporation. 115 oil immersed link panels and 30 oil circuit breaker panels. (E.S.B. 3990/56. Ten/18010.)*

Southern Rhodesia.—21st March. City of Bulawayo Electricity Department. H.v. underground cable, joint and splitter boxes, sealing ends and surge absorbers. (E.S.B. 4148/56. Ten/18041.)* H.v. and l.v. cable. (E.S.B. 4147/56. Ten/18031.)*

Stockport.—15th March. Borough Council. Electric lamps, lanterns, chokes, capacitors and electric time switches for use in street lighting for the year ending 31st March, 1957. Borough surveyor, Town Hall.

Uruguay.—29th May. Administracion General de las Usinas y los Telefonos del Estado. 150 kV overhead line. (E.S.B. 4021/56. Ten/18022.)* 6th April Administration Nacional de Puertos. Cable and switch boxes. (E.S.B. 4133/56. Ten/18042.)*

ORDERS PLACED

Barrow in Furness.—Corporation. Electrical installation work at the North Walney County Junior School (£2,257).—The Four Cousins.

Carlisle.—Education Committee. Electrical installation at the new Pennine Way Junior School (£2,391).—George Bowman.

Christchurch (Hants).—South West Metropolitan Regional Hospital Board. Electrical work for adaptations to the female block at the Christchurch Hospital (£3,845).—Northbourne Electrical Co.

London.—L.C.C. Electrical installations in blocks Nos. 1 and 2 of flats at Heath Road site, Wandsworth (£6,203).—Holliday & Son (Electrical).

Stockton-on-Tees.—Corporation. Electrical installation at Redbrook Junior and Infants' School (£1,804).—Messrs. Emmerson.

Wednesfield.—U.D.C. Lanterns, lamps and columns for Ashmore Estate (£4,463.)—Revo Electric Co., Ltd.

Whitley Bay.—Town Council. Electrical installations in 50 houses on the Earsdon Grange Estate (£1,344).—A. F. Jemison.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Amble.—Pithead baths at Hauxley Colliery; N.C.B. Architects' Department, Ashfield Towers, Gosforth, Northumberland.

Bewdley.—Houses (40) and old people's bungalows (40) on Springhill estate; borough surveyor, Municipal Offices.

Billingham-on-Tees. — Research block; Davy & United Roll Foundry, Ltd., Empire Works, Haverton.

Brackley.—Houses (74), in six parishes; R.D.C. surveyor, Rural Council Offices, Brackley Lodge, Brackley, Northants.

Brighouse.—Library at Southowram; H. A. Sneezum, borough surveyor, Commercial Street.

Broxbourne.—Factory and offices; Broxlea Products, Ltd., 70, High Street.

Burnham-on-Crouch.—County secondary school; Johns, Slater and Haward, architects, 32, Foundation Street, Ipswich.

Canterbury.—Swimming bath at Worthgate Place (£95,000); L. H. Wilson, city architect, Dane John.

Chailey.—Secondary school (£105,706); E. A. Verger, county architect, County Hall, Lewes.

Chester.—Out-patients' department for Royal Infirmary; architect, Liverpool Regional Hospital Board, 88, Church Street, Liverpool.

Chilworth. — Tillingbourne Secondary Modern C.E. School; Hiscock and Duncan Scott, architects, 32, London Road, Guildford.

Coventry.—Departmental store at Walsgrave Road for Hogarth Warehouses, Ltd.; C. F. Redgrave & Partners, architects, 6, The Quadrant.

Darlington.—Four-storey laboratory and drawing office wing, College of Further Education; borough architect.

Darlington.—Haughton Secondary Modern School (£225,216); borough architect.

Dorchester.—Dwellings (73), Mill Street area; L. Magnus Austin, architect, Bowling Alley Walk.

Grimsby.—Conversions at premises in Ladysmith Road to form factory; Berkley Hygienic Products, Ltd., Riby Street.

Harlow.—Primary school, Tye Green; Woodroffe, Buchanan and Coulter, architects, 5, Bedford Row, London, W.C.1.

Harrogate.—St. Robert's R.C. Secondary School; Weightman & Bullen, architects, 76, Rodney Street, Liverpool.

Hartlepool.—Houses (90), Blandford Street area; J. H. Wood, borough engineer.

Hastings.—Dwellings (303), Halton area; borough surveyor.

Showrooms, Carlisle Parade; Callow & Burstow, architects, 59, London Road.

Hatfield.—Houses (30), Redhall estate; Davey Estates, Ltd., Station Road, Boreham Wood.

Hebburn (Co. Durham).—Houses (303), Monkton Lane estate; U.D.C. surveyor.

Leeds.—Two-storey factory and office building at Parkside, Hunslet, for Porterprint, Ltd.; J. Ledgard & Sons, Ltd, Ventnor Street, Leeds.

Factory at Seacroft for Forgrove Machinery Co., Ltd.; Higgs & Hill, Ltd, 33, St. Paul's Street.

Leigh.—R.C. church, school and presbytery at Higher Fold estate; Weightman and Bullen, architects, 76, Rodney Street, Liverpool.

Radnorshire.—County secondary grammar school at Llandrindod Wells; Willink and Dod, architects, Cunard Buildings, Liverpool, 3.

Salford.—Hope Hall Secondary Modern School for E.C.; G. & J. Seddon, Ltd., Little Hulton, Near Bolton.

Scraptoft.—Infants' school (£45,650); county architect, Leicester.

Sedgefield.—Houses (74) for R.D.C.; G. M. Pearson & Son, Ltd., Houghton Road, Hetton-le-Hole, Durham.

Shrewsbury.—Houses (135), at Meole Brace; borough surveyor, Guildhall.

Warwick.—Houses (112), bungalows (27) and maisonnettes (48) at Percy Housing estate; Jackson & Edmonds, architects, 116 Colmore Row, Birmingham.

West Bromwich.—Houses (138), Tenscore Street; borough surveyor, Town Hall.

Wigan.—Large departmental store at Standishgate for John Pendlebury, Ltd.; J. Jarvis & Sons, Ltd., Dane Road, Sale, Ches.

Wolverhampton.—Houses (85), Perry Hall estate, Wednesfield; borough engineer, Town Hall.